Drivers of adoption and spread of wildlife management initiatives in Mexico

Cristina Romero-de-Diego\textsuperscript{1,2} | Angela Dean\textsuperscript{2,3} | Arundhati Jagadish\textsuperscript{4} | Bradd Witt\textsuperscript{1} | Michael B. Mascia\textsuperscript{4} | Morena Mills\textsuperscript{2,5}

\textsuperscript{1}School of Earth and Environmental Science, University of Queensland, St. Lucia, Queensland, Australia
\textsuperscript{2}Centre for Biodiversity and Conservation Science, The University of Queensland, St. Lucia, Queensland, Australia
\textsuperscript{3}Centre for the Environment, Institute for Future Environments, Queensland University of Technology, Brisbane, Queensland, Australia
\textsuperscript{4}Moore Center for Science, Conservation International, Arlington, Virginia
\textsuperscript{5}Faculty of Natural Sciences, Centre for Environmental Policy, Imperial College London, South Kensington Campus, London, UK

Correspondence
Morena Mills, Faculty of Natural Sciences, Centre for Environmental Policy, Imperial College London, South Kensington Campus, London, SW7 2AZ, UK.
Email: m.mills@imperial.ac.uk

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Abstract
Conservation initiatives rarely achieve the scale required to respond to ongoing biodiversity loss. Understanding what drives the adoption of conservation initiatives provides key insights into how initiatives expand to a scale necessary for effective conservation outcomes. In this article, we identified characteristics of conservation initiatives, adopters, and context that influenced the adoption of extensive Wildlife Management Units (UMAs) in Mexico. We interviewed 22 experts to gather their perceptions about the factors driving the adoption and spread of UMAs, and their interactions. We used Diffusion of Innovation Theory and qualitative data analysis to develop a theory of change based on the experts' perceptions that illustrates what led landholders to adopt UMAs. We found that: (a) the adoption of UMAs depended on the landholders' ability to learn about, register, and implement them; (b) alignment with the landholders' objectives and private tenure facilitated adoption, reflecting the likelihood and ease of participation, respectively; and (c) observability of benefits and the availability of technical advice were key to adoption, influencing the speed of adoption by facilitating learning. Our empirically derived theory of change describing the adoption of UMAs revealed focused and clear hypotheses that can be further tested quantitatively.

KEYWORDS
conservation initiatives, diffusion of innovation, general elimination methodology, practitioners' perceptions, qualitative evaluation, theory of change, UMAs, wildlife conservation, wildlife management units

1 | INTRODUCTION

Despite growing global interest in biodiversity conservation (Dirzo et al., 2014; Steffen, Broadgate, Deutsch, Gaffney, & Ludwig, 2015), many conservation initiatives rarely achieve the scale required to respond effectively (Dehgan & Hoffman, 2017). Conservation initiatives are policies, programs, and projects, often novel governance systems designed to shape how people interact with resources to protect biodiversity (adapted from Mascia et al., 2017). While most land-based conservation initiatives rarely reach their intended scale, some have spread across hundreds or thousands of adopters providing researchers with an opportunity to identify what enables...
their spread (Mills et al., 2019). Examples of these include Private Protected Areas in Australia (Fitzsimons, 2015) and locally managed marine areas in the Pacific (Govan, 2009). Despite the importance of catalyzing the implementation of conservation initiatives across meaningful scales, there are very few studies to date examining the factors driving their adoption and spread (Mascia & Mills, 2018).

Diverse psychological and social theories inform our understanding of what drives people’s engagement with conservation, and the importance of social influences on behavioral intentions and adoption. Most of these theories focused on characteristics of the individual to explain the drivers of the behavior (i.e., adoption). For example, the Theory of Planned Behavior (Ajzen, 1991) describes behavioral intentions as being dependent on the individual’s attitudes and perceived control towards the action, and the perceived expectation of others (i.e., social norms) to perform that action. Social learning theory (Bandura & Walters, 1977) suggests that we learn by observing others in addition to our own experiences. In contrast, Diffusion of Innovation Theory goes beyond the focus on the individual adopter; it includes characteristics of the initiative (as perceived by potential adopters) and the broader social–ecological context (hereafter referred to as context) surrounding the initiative and its adopters (Mascia & Mills, 2018; Rogers, 2003).

A growing number of studies use Diffusion of Innovation Theory to understand what drives the adoption of resource management or conservation initiatives. Abernethy, Bodin, Olsson, Hilly, and Schwarz (2014) investigated drivers of community-based resource management within villages in the Solomon Islands. They found that the initiative's compatibility with previous resource management experiences or the community witnessing the initiative's benefits contributed to adoption. Lewis-Brown et al. (in review) demonstrated that one of the most important characteristics of the locally managed marine areas in villages in Madagascar was the perceived benefits for future generations. While these studies provide useful insights into adoption, the Diffusion of Innovation Theory highlights the importance of considering not just individual characteristics driving adoption, but also the interaction among them (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004). To our knowledge, no study has comprehensively examined how the characteristics of the adopters, the initiative, and the broader context interact and facilitate adoption and national spread of a conservation initiative. An in-depth qualitative exploration of the characteristics driving adoption can provide insight into their relative importance and synergies.

This study aims to understand what drove the adoption and spread of the Extensive Wildlife Management Units (In Spanish: Unidades de Manejo para la Conservación de la Vida Silvestre or the acronym UMAs) in Mexico, using the lens of Diffusion of Innovation Theory. Extensive UMAs are a voluntary land-based policy instrument that allows landholders to sustainably use the plants and animals growing or roaming free on their rural properties, with coupled objectives of biodiversity conservation and rural development. In Mexico, wildlife is owned by the federal government, engagement in UMAs grants landholders the rights to access, manage, and benefit from it. Efforts to evaluate the environmental and social outcomes of UMAs have been initiated (CONABIO, 2012); however, very little is known about what drives adoption. In this study, we develop a theory of change to illustrate the drivers of adoption (James, 2011). Specifically, we develop a theory of change using General Elimination Methodology (GEM; Salazar, Mills, & Veríssimo, 2019), a qualitative evaluation approach that seeks to understand the social processes behind the observed outcomes (White & Phillips, 2012). This approach embraces the complexity of initiatives and provides an opportunity to examine attribution of cause and effect when sample sizes are small, or there is limited baseline data (White & Phillips, 2012). Mills et al. (2019) found UMAs followed a slow-fast-slow dynamic of adoption, consistent with the dynamics expected from other innovations based on Diffusion of Innovation Theory. Our study contributes to understanding the vast but uneven distribution of UMAs across rural landscapes, both across different land tenures and geographies. We also hope to spark new directions in conservation research by highlighting the complexity of the social processes that drive adoption using a new methodology within the conservation field.

2 | METHODS

2.1 | Study setting

Our study focused on the adoption of extensive UMUs by the landholders in rural Mexico (hereafter, referred to as just UMAs). The sustainable use of wildlife (i.e., plants and animal species) can either be extractive (i.e., parts or individuals are removed; e.g., hunting, harvesting leaves) or non-extractive (i.e., no parts or individuals are removed; e.g., wildlife watching). In contrast, intensive UMAs focus on the reproduction of wildlife species under strict management and usually enclosed conditions (e.g., nurseries, zoos, breeders).
The Mexican government conceptualized UMAs in the National Program for Wildlife Conservation and Productive Diversification of the Rural Sector 1997–2000 (INE-SEMARNAP, 1997). This program was underpinned by the General Law for Ecological Balance and Environmental Protection 1988 (SEMARNAP-PROFEPA, 1998) and aimed to strengthen public policy on biodiversity conservation while making it compatible with rural economic development (CONABIO, 2012). The General Law for Wildlife by 2000 (Figure 1; SEMARNAP, 2000) and the rules of the General Law for Wildlife by 2006 (SEMARNAP, 2006) legally supported UMAs.

We focused on UMAs because of both the high number of registrations at the national level and unevenly distributed adoption patterns across Mexico’s rural community. This allows us to explore diverse adopter and contextual characteristics driving adoption. Mexico has high ecological and social diversity. Rural people manage more than 90% of the land, both under private and social tenure (Morett-Sánchez & Cosío-Ruiz, 2017). There are two main types of social tenure in Mexico: ejidos—a form of communal property in which land is distributed to a group of individual subsistence farmers but overseen by the Mexican state government who holds ownership rights; and indigenous land—land with recognized indigenous ownership before the Spanish conquest and formally recognized as a land tenure system after the Mexican Revolution (Valdez, Guzmán-Aranda, Abarca, Tarango-Arámbula, & Sánchez, 2006).

Recorded registration of UMAs started in 1999 (Figure 1) with 2061 UMAs registered that year; 90.1% of these were on private land, partially due to the registration of existing hunting ranches (Figure 1; SEMARNAT, June, 2020). Between the years 2000 and 2013, registration stabilized at around 500 UMAs a year. From 2013 to 2017, the rate of adoption decreased to less than 200 registrations per year. The total cumulative number of UMAs registered by 2017 was 9,867 (Figure 1), from which private land represented 76.48%, ejidos 21.50%, and indigenous land just 2.02%. The Northeast region (i.e., Coahuila, Nuevo León, and Tamaulipas) had 41.50% of UMAs by 2017 (Figure 2 and Figure S1). Registrations in the Central West and South/Southwest regions increased over time: they contributed to only 2.51 and 2.08%, respectively, to the total number of UMAs registered in 1999, which increased to a cumulative contribution of 13.50 and 11.23%, respectively, by 2017.

### 2.2 Experts’ theory of change driving adoption

We generated a theory of change focused on the process driving adoption of UMAs as perceived by experts with
experience of UMAs (i.e., government and conservation NGO staff, private consultants, researchers, outreach, and extension officers). To identify how key factors facilitated or hindered adoption, we used GEM (Scriven, 2008; White & Phillips, 2012). GEM, a theory-driven qualitative evaluation method, is based on the principle that all outcomes have a cause or set of causes. GEM offers an opportunity to understand the processes that lead to observed outcomes (i.e., adoption of UMAs) instead of focusing only on the outcomes (Chen, 2012). Evidence-based analysis is a priority in conservation (Sutherland, Pullin, Dolman, & Knight, 2004), and GEM is of particular interest when quantitative approaches are not possible due to, for example, unavailable baseline data (Bottrill, Hockings, & Possingham, 2011).

GEM involves systematically identifying and then ruling out alternative causal explanations of observed outcomes (White & Phillips, 2012). It consists of three main steps (Scriven, 2008): (a) identify possible causal pathways (e.g., increased relative advantage or perceived benefits of an initiative when compared to the status quo or alternative options) for the outcome of interest (i.e., adoption of UMAs), (b) identify conditions necessary for each possible cause to affect the outcome (e.g., positive benefit/cost ratio for the adopter), and (c) identify whether or not the conditions are present (e.g., were benefits higher than costs for the adopter). While GEM outlines a set of logical steps, the researchers choose the tools used to follow them. To identify key alternative hypotheses, we first reviewed relevant literature and then conducted interviews with experts. We then rule these hypotheses in or out by triangulating the interview data with existing written evidence (Figure S2).

2.2.1 | Gathering hypotheses

To identify potential factors facilitating or hindering the adoption of UMAs, we reviewed grey \((n = 3)\) and peer-reviewed literature \((n = 21)\) on UMAs (Appendix 2). We organized qualitative information on the presence or absence of different factors using Diffusion of Innovation Theory (Rogers, 2003) and coded for additional factors mentioned within the literature that did not fit the theory. We merged factors when the existing UMA literature described their interaction as influencing adoption or if they overlapped (e.g., willingness to cooperate and trust; or values, beliefs, and personality traits), resulting in 26 factors (Table S1). When defining the final list of factors to be considered within the interviews, we had to balance the richness of the data and not overwhelming participants with too many factors.

2.2.2 | Participant interviews

We conducted interviews with experts to explore their perceptions of factors identified from the review, their relative influence, and the potential role of additional factors influencing the adoption of UMAs across Mexico. We invited representatives from government agencies (federal, state), NGOs, developmental organizations, universities, independent consultants, and extension officers (technical officers) to participate in expert interviews. We aimed to explore UMAs within a wider context, thus targeted experts instead of landholders because we assumed experts could tell us more about the broader processes (e.g., funding, policies) driving trends
in adoption. In contrast, landholders would have a much better understanding of their own reasons to adopt and should be the focus of future studies. We used non-probabilistic purposive sampling, following a snowballing technique (Newing, 2010), and worked towards data saturation (Guest, Bunce, & Johnson, 2006).

We conducted 22 interviews, resulting in a response rate of 53.66% (number of people contacted = 41). Most participants had more than 5 years of experience working with UMAs and had moved through diverse roles and institutions (Appendix 4, Figure S3 and Table S2). We conducted audio instead of video calls to minimize the potential technical difficulties associated with participants having access to limited internet connectivity; audio calls can exhibit similar reliability to face-to-face interviews (Sturges & Hanrahan, 2004). We carried out the interviews in Spanish, between January and July 2018, and recorded them with the participants’ consent. We transcribed the interview audios using oTranscribe, and coded the transcripts using Nvivo 12 (QSR, 1999). We obtained ethical approval from The University of Queensland (#201709-03). The semi-structured interviews were on average 1 hr 30 min long and included two sections (Appendix 5). Section 1 comprised open-ended questions about participants’ background and experience with UMAs, and their perception about their adoption, spread, and benefits and costs. Section 2 was an online activity where participants identified factors facilitating or hindering adoption; it was delivered as a Qualtrics survey link and discussed in real-time with the interviewer. Using pile sorts (Newing, 2010) adapted to online interviews, participants identified the factors impacting UMA adoption and discussed how they related to each other. We provided participants with universal explanations of the factors. First, participants separated “influential” from “non-influential” factors. During this step, participants also had the option of adding new items they considered important. Second, participants then categorized influential factors as “most influential” or “least influential.” To define the relative importance of the factors in facilitating or hindering adoption, participants were then asked to organize the “most influential” factors on a scale of influence: from most influential at the top of the box to least influential at the bottom. We then asked participants to discuss how the “most influential” factors influenced adoption; links between factors were identified by asking participants to describe how each “most influential” factor related to other “most influential” factors. Results were exported as PDF files. Two participants did not undertake the ordering activity, as they reported to be more informed about intensive (e.g., enclosed breeders) rather than extensive UMAs during the interview.

2.2.3 Data analysis

We focused on the ordering activity during the data analysis and referred to the open-ended questions to ensure we retained context and meaning. We used deductive content analysis to code responses and elicit each participant’s theory of change (White & Phillips, 2012). We coded each of the 26 factors separately. We used Nvivo 12 and Excel 365 to summarize participants’ responses. We noted the factor, the participant’s interpretation of the factor, how it influenced adoption, and its relationship to other factors. To test the validity of our coding system, a second researcher analyzed three transcripts chosen at random. We found overall intercoder reliability of 80.3%, calculated by dividing the total number of agreements for all codes by the total number of agreements and disagreements for all codes combined (Campbell, Quincy, Osserman, & Pedersen, 2013).

We developed a combined theory of change by including only factors identified as “most influential” by at least 10 out of 20 participants (≥50% agreement); 14 of the initial 26 factors were included. Additionally, to include a link between two selected factors, at least three participants had to agree a relationship existed (≥15% agreement). We selected these thresholds based on the change within the complexity of the final theory of change; we believed higher thresholds removed much of the substance within the theory of change while lower thresholds led to unnecessary complexity (Figure S4). We did not include the remaining 12 factors or other links in the theory of change that did not meet the above criteria under the assumption that lack of agreement for these hypotheses meant they played a less important role in adoption. To further understand the factors driving adoption with the greatest consensus, we counted the number of times participants selected each factor within their top five “most influential” factors.

2.2.4 Validating the factors

To validate the selected factors, we systematically assessed if the evidence supported the remaining 14 hypotheses (Table S3). We differentiated between: (a) direct evidence, when evidence was based on analysis of primary or secondary data; and (b) indirect evidence, when evidence was based on document reviews or the author’s opinion. We considered one piece of direct evidence or three pieces of indirect evidence enough to validate a factor. We began our search for evidence by screening the sources we had collected for the review. We also reviewed some of the documents shared with us by participants. When necessary, we searched both
Google and Google Scholar for the factor using four phrases related to the factor (two in English and two in Spanish), then reviewed the first 50 results for both engines for each phrase, or until we found direct evidence supporting it.

3 | RESULTS

3.1 | Experts' theory of change and top factors

We identified factors, their relationships, and their influence on the adoption of UMAs to develop a combined experts' theory of change (Figure 3). Out of the 26 factors presented during the sorting activity, 14 were perceived to influence the adoption of UMAs by at least 50% of the participants (n = 10, Table S4). Each of these 14 factors was validated by at least one direct piece of evidence (Table S3) and incorporated into the theory of change (Figure 3). Only one participant used the blank cards to provide an additional factor (degree of knowledge and commitment of technical officer with the adopter); this factor was coded as part of the advice, facilitation, and capacity building. One factor was perceived to have mostly a negative effect on adoption (i.e., bureaucracy and paperwork), while the rest were perceived to have a positive effect under particular circumstances (e.g., established and accessible markets for wildlife use when adopting an UMA with commercial objectives).

The importance attributed to the 26 factors presented to participants during the sorting activity varied widely (Figure S5). Over a third (35%, n = 7) of the participants agreed that the most important factors driving adoption were: (a) observability of benefits (45%, n = 9); (b) advice, facilitation and capacity building (35%, n = 7); (c) interests and objectives of adopters (35%, n = 7); and (d) property type (35%, n = 7). We identified three causal pathways by which the factors might have influenced the adoption of UMAs: (a) pre-existing conditions facilitating registration and implementation, (b) learning, and (c) the perceived relative advantage of the UMAs.

3.1.1 | Pre-existing conditions facilitating registration and implementation of the initiative

Participants said the adoption of UMAs by landholders depended on access to advice and facilitation (Table S4; n = 17). Thirty-five percent of participants chose extension support—including the provision of technical advice, facilitation of processes, and capacity building and training—within their top five factors for adoption.

The mandatory paperwork required to adopt an UMA was perceived to be complex and required extensive technical knowledge (n = 10), along with a technical understanding of policies and the development of wildlife species management and business plans. Participants said extension support was critical as technical officers enabled adoption by “translating” technical information from the government to the people. Their advice and facilitation were considered important for guiding decisions on UMA design and helping with registration and implementation. A participant highlighted:

“The fact that you’ve got a document [registration] doesn’t mean you’re ready to sell, to manage, to use [wildlife resources]. There is lots of knowledge to assimilate” (ID24)

Participants said that educating adopters on the skills needed to manage UMAs increased the chances of adoption. The training was both empowering and lucrative for adopters (e.g., they developed the skills to guide their visitors).

The participants highlighted that they needed access to quality extension support; technical officers needed sufficient knowledge, skills, and time to engage. Adopters with lower literacy levels needed deeper engagement, facilitation, and capacity building efforts. Quality extension support built trust and willingness to cooperate and helped landholders tailor UMAs to their own interests and objectives. Capacity building and refresher courses for technical officers were considered important by participants. One participant reported:

“All UMAs require technical assistance, but the technical officers also need training. They need to constantly update their knowledge on management strategies and conservation of habitat and species populations”. (ID15)

In the initial stages of implementing UMAs, the government provided technical advice; over time, the scheme increasingly relied on technical officers, who were mostly external entities such as private consultants, organized groups of UMA-adopters (e.g., National Association of Diversified Farmers, or ANGADI by its acronym in Spanish), or NGOs. In most cases, adopters needed to pay for extension support (becoming an essential part of the initial investment needed to adopt UMAs) unless they had access to external funding. The total cost varied with the difficulty of the paperwork, the travel time, and the complexity of the wildlife management and business plans needed for the envisioned UMA. Participants highlighted that the privatization of needed technical
FIGURE 3  Theory of change showing the factors influencing adoption of UMAs as perceived by participants. The factors displayed were selected by at least 10 out of 20 participants (≥50% agreement). The links displayed were identified by at least 3 out of 20 participants (≥15% agreement). See Table S1 for definitions of the factors and Table S2 for the number of participants selecting a factor or mentioning a link.
services led to: discontinuity of extension support (e.g., when subsidies covered technical assistance for registration but not implementation); fewer training opportunities for technical officers; more leeway for softer interpretation of policies (e.g., unjustified predator control in UMAs under request from adopters), and; corruption (e.g., benefit grabbing, for instance by controlling marketing channels). While conflict resolution mechanisms were available to deal with such issues with extension officers, participants said most adopters chose not to invest additional resources in these processes.

Bureaucracy was considered less of a challenge for states on the Northern border because they could register UMAs locally rather than in Mexico City (Figure S1). In contrast, those living further from registration offices or in more remote rural areas were less familiar with formal government paperwork and found registration more difficult. Many of these landholders were often not even registered for taxation purposes. Access to external funds also increased the capacity to invest in the implementation of UMAs (e.g., planting native palms or building the necessary infrastructure; n = 11).

Willingness to cooperate and mutual trust between the individuals of a group of adopters, between adopters and technical officers, and among all the actors involved (including government) was also considered critical for adoption (n = 12). Additionally, for UMAs with commercial objectives (e.g., commercial hunting, palm leaves extraction for ornamental purposes), access to markets and the ability to engage with a market economy were considered essential (n = 13 and n = 12, respectively).

3.1.2 | Learning about the initiative and its benefits

Participants considered the potential adopter’s access to credible information about the adoption of UMAs and its benefits important for adoption. The promotion of the initiative by governments and other organizations (n = 14), the visibility and communication of benefits through visits, assistance, courses, and events were all mediums for information transfer (n = 10).

The observability of benefits of the UMAs was considered to be the most important factor driving adoption, cited by 45% of the participants within their top five factors. Visible benefits encouraged the neighbors to adopt it and the landholder to maintain it. Observability of benefits was considered essential to learning about the initiative. Of particular importance was the observability of economic benefits of UMAs (e.g., adopters gaining additional income from the use of wildlife to spend on their priorities such as improving water-related infrastructures) as it transformed an abstract concept into tangible outcomes. Participants said farmers were also drawn to adopting because of the fear of missing out on additional income from diversifying land use. Apart from directly observing the benefits, the experts also considered communication of the benefits, from neighbors who had already adopted or the technical officer, critical for information transfer. One participant said:

“people want to establish an UMA because they heard their neighbour, their colleague, the people from other states that are talking about the benefits of UMAs...they assimilate this knowledge, and many times this is what triggers this activity [the UMA].” (ID24)

3.1.3 | The perceived relative advantage of the initiative

UMAs were considered advantageous when the existing land use was compatible with UMAs, and the landholder had the ability and willingness to engage. The initial investment needed when compared to the investment capacity (n = 13), to provide more benefits than costs from the wildlife use (n = 14) and property type (n = 13) influenced suitability. For instance, properties that offered comfortable accommodation or complementary activities (e.g., zip-line, climbing) for tourists could gain larger benefits from adoption than those who did not, as tourists attracted by the UMAs would likely use their other facilities. Our participants mainly referred to economic costs and benefits for the adopters, such as paying for extension support or the extra income obtained from selling wildlife products. In addition, they identified potential environmental benefits from UMAs such as land and soil improvement or the provision of ecosystem services. Participants said that landholders compared the cost and benefits of wildlife use to those delivered by traditional or established land uses (e.g., agriculture, livestock; n = 10).

Property type was considered important in influencing adoption by 35% of participants because it reflected the adopters’ socio-economic characteristics and land tenure, impacting their perception on the balance between the social, economic and environmental benefits and costs (i.e., relative advantage) of adoption (Figure 1). There were enormous differences in adopters’ socio-economic characteristics given the high heterogeneity of the rural population in Mexico. Private landholders usually had larger extensions of land, higher literacy rates, and financial resources, while ejidos and indigenous communities had smaller properties, lower literacy rates, and greater
resource constraints. Land tenure influenced the adopters’ ability to make decisions. For example, private large properties involving only one adopter involves simpler decisions than when an agreement is required between multiple small private properties or groups of people (e.g., within social land). Ejidos and indigenous communities also differ extensively on governance (e.g., how different groups are organized, make decisions and distribute benefits). Historically ejidos were considered to be more self-organized and heterogeneous than indigenous communities. One participant explained:

“Most communities in Mexico are formed by indigenous peoples. [...] The ejidos are lands granted, they are formed by people from diverse backgrounds who organised themselves to get the ejido, therefore they are already different [from indigenous communities]. They are people who already had that [self-organising] capacity, so much so, they got land granted to them. [...] Private landholders are generally more qualified, grouped in associations where the level of knowledge is totally different”. (ID17)

“To engage each of them [private landholders, ejidos, indigenous communities] is different. It’s easier to facilitate and understand private property. If you convince the landholder, you have already convinced all the hectares on the land. To convince a community [or ejido] requires many meetings, for the members to reach an agreement, some want it, some don’t, [...] and the initiative gets complicated”. (ID17)

Similarly, participants (n = 11) highlighted that compatibility with the landholders’ interests and objectives played an important role in the landholders’ willingness to engage and adopt an UMAs; 35% of participants included this factor within their top five. These interests and objectives were diverse, including harvesting a given species for commerce or subsistence and strict conservation. One participant said:

“There is a bit of everything in regards to interests, from groups that want to conserve everything and to leave absolutely everything untouched, which is undoubtedly a valid perspective and ethically and aesthetically acceptable, to those people who just want to produce deer”. (ID5)

Interests and objectives were also dynamic, changing over time. In the case of ejidos, these interests needed to be agreed upon or at the very least accepted by other landholders. Participants reported that the landholders’ interests and objectives influenced both their initial willingness to invest in adopting an UMA, and the initial investment needed. Thus, interests and objectives must be compatible with the adopters’ capacity to invest, which is very heterogeneous in Mexico.

4 | DISCUSSION

Understanding what drives widespread adoption of conservation initiatives is critical for their design, implementation, enabling rapid scaling, and enduring impact. In this study, we evaluated how the initiative, adopter, and context characteristics influence the adoption of UMAs in Mexico. Our theory of change highlighted that the ability to learn about, register and implement the initiative, as well as its perceived relative advantage, were critical in facilitating the adoption of UMAs over the last 20 years. The most commonly identified characteristics influencing adoption were the adopter type (identified by the property type), the compatibility with the adopter’s interests and objectives, the accessibility of extension support (including technical advice, facilitation and capacity building), and the observability of benefits.

We found that adoption of UMAs was dependent on the property landholders having the ability to learn about, register and implement UMAs. While this seems intuitive, it highlights the need for local context to be carefully considered in the design of conservation initiatives (e.g., Brooks, Waylen, & Borgerhoff Mulder, 2012; Prager & Posthumus, 2010). Interactions among the characteristics of the initiative, its adopters, and context are what determine adoption (Greenhalgh et al., 2004). Thus, those familiar with the challenges and opportunities of the existing governance processes should formulate conservation initiatives and the process for engagement in situ. We found that some of the pre-existing conditions necessary for registration and implementation of UMAs in Mexico included: access to extension support and cooperation amongst stakeholders to support adoption.

Private tenure and compatibility with the needs of landholders facilitated the adoption of UMAs, reflecting both the ease and the likelihood of participation, respectively. Private landholders typically have larger properties, stronger literacy, and greater financial resources; these socioeconomic characteristics have been associated with early adoption of other innovations (e.g., Daba, 2003; García De Jalón, Iglesias, & Barnes, 2016; Ghadim, Pannell, & Burton, 2005; Prager & Posthumus, 2010). Alignment with the landholder’s objectives is also known to be critical for adoption (Ansell, Gibson, & Salt, 2016; Greiner, Patterson, &
Miller, 2009; Pannell et al., 2006). Landholders adopted UMAs for diverse reasons, including economic benefit, conserving social traditions (e.g., subsistence hunting), or restoring land condition; participants suggested that this flexibility increased the likelihood of adoption. Landholders of properties suitable for these uses (e.g., properties with a lot of game are better for hunting tourism) were more likely to adopt. Our research complements previous research that highlights how people engage with conservation initiatives for numerous reasons (e.g., locally managed marine areas in the Pacific; Jupiter, Cohen, Weeks, Tawake, & Govan, 2014), emphasizing flexibility as an important design characteristic of future conservation initiatives as it enables adopters to tailor the initiative to their own needs.

The visibility and communication of benefits (i.e., observability) and the availability of technical advice were also considered key to the adoption of UMAs. Research suggests these factors influence adoption speed by facilitating learning (Kuehne et al., 2017). Identifying how to enhance learning about conservation initiatives is a challenge for NGOs and governments around the world. If learning can happen through mass media, then the adoption of the initiative may occur without the need for interpersonal communication. However, in many cases, interactions between potential adopters and existing adopters or facilitators will be necessary (Rogers, 2003). Such interpersonal channels played an important role in persuading an individual to adopt other innovations (Liu, Bruins, & Heberling, 2018; Niemiec, Willer, Ardoin, & Brewer, 2019; Rogers, 2003). Not only the access but the quality and credibility of the information received was fundamental to the adoption of UMAs in Mexico (also see Baumgart-Getz, Prokopy, & Floress, 2012). Government reliance on outside agencies for information transfer, as described by our participants, means landholder capacity to learn about the initiative will depend on the observability of benefits, other adopters, and availability of external actors (e.g., private consultants, NGOs).

Diffusion of Innovation Theory provides a useful framework to understand the adoption and spread of UMAs and complements other theories. Most behavioral theories (e.g., Theory of Planned Behavior; Ajzen, 1991) focus on the adopter's characteristics to understand the drivers of the behavior (i.e., adoption). Diffusion of innovation theory provides a broader perspective on adoption by adding characteristics of the innovation and the socioecological context. Some of the key drivers for UMA adoption went beyond the adopter, for instance the initiative's observability and the access to extension support, and they would not have been otherwise identified.

UMAs were adopted mainly by private landholders while, for example, less than 8% (k = 29,554; 2097 adopted) of ejidos registered UMAs by 2016 (Mills et al., 2019). This suggests two biases associated with the diffusion of innovations. First, the pro-innovation bias is the assumption that initiatives are advantageous to all the members of a social system (Rogers, 2003). For example, transferring successful models across geographies and adopter types assuming they would always work instead of custom designing initiatives for specific types of adopters and contexts. In the case of UMAs, early UMAs models, built around wealthy foreigners hunting big ungulates, were transferred to Southern Mexico where conditions were not suitable. Second, the inequality and justice bias implies that initiatives often spread through existing power structures that determine access to the innovation, resources, and change agents (Rogers, 2003). For example, landholders who belonged to landholders’ associations specialized in managing UMAs would have faster and easier access to information about the initiative and quality technical advice. Our results highlight the importance of understanding the target population and their context to design initiatives and diffusion strategies (e.g., via communication programs) that facilitate the adoption and spread of UMAs across heterogeneous adopters.

Developing theories of change during interviews was critical to understanding how the initiative, adopter, and context characteristics contribute to facilitating or hindering adoption and the dynamics between these characteristics. Although time consuming, GEM provides a validated and synthesized narrative of the process and critical characteristics that drive adoption. Simplifying the drivers of UMA adoption to 14 key characteristics is particularly useful, given the complexity of UMAs, and the diversity of adopters and adoption contexts. Future studies could examine differences in narratives around UMA adoption for particular regions or types of adopters. This methods’ challenge was balancing richness and parsimony when identifying the number of characteristics presented to audiences. Minimizing the number of initial characteristics in the ordering activity reduces cognitive challenges; however, a comprehensive list allows the interviewer to ensure all potential characteristics are considered. While generating the theory of change, GEM enabled us to disentangle potential causal pathways (e.g., what characteristics are more likely to influence UMAs relative advantage), test assumptions formed over time (e.g., is access to markets important for all UMAs), generate a deeper understanding of how the different characteristics contributed to adoption, and unveil characteristics that are currently missing from the scientific literature (e.g., the importance of the benefits of UMAs being observable). Importantly, the theory of change revealed focused and clear hypotheses that future research can test quantitatively.
To design conservation initiatives that reach scale, we need to understand what drives their adoption. Our theory of change results suggest there are three interconnected pathways to facilitate the adoption of UMAs: (a) reduce barriers to adoption by designing the initiative to be compatible with the characteristics of the remaining potential adopters; (b) increase the observability of the initiative and its benefits, and provide sustained technical assistance throughout the whole process of adoption, implementation and management; and (c) custom-design UMAs, so they can contribute to multiple objectives and aspirations of the adopters. Sustained local engagement and targeted diffusion strategies appear fundamental to the adoption of UMAs, and a necessary step to more effectively engage ejidos and indigenous communities with this initiative.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Cristina Romero-de-Diego and Morena Mills designed research, analyzed, and interpreted data. Cristina Romero-de-Diego organized and performed interviews. All authors discussed content and visual material, wrote, and edited the article.

DATA AVAILABILITY STATEMENT

Data is available upon request from CR: c.romero@uq.edu.au.

ETHICS STATEMENT

The study was approved by the University of Queensland Ethics Committee (#201709-03).

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Additional supporting information may be found online in the Supporting Information section at the end of this article.

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