INTRODUCTION

Many Indigenous communities around the world have experienced rapid modernization and associated socioeconomic change in the last decades (Hoehn & Thapa, 2009; Jacquelin-Andersen, 2018; Sotomayor et al., 2019). Such processes have catalysed shifts from traditional livelihoods, lifestyles and social interactions to lifestyles characterized by capital accumulation and consumerism (D’Ambrosio & Puri, 2016; Karst & Nepal, 2019; Rosnon et al., 2019; Sotomayor et al., 2019). The drivers of livelihood shifts in indigenous settings...
are very diverse and context specific, and have included among others tourism development (Leu, 2019; Movono et al., 2018) and community relocation (Zen et al., 2020).

Modernization-driven shifts from traditional (and often subsistence-based) livelihoods to formal economic activities have intersected strongly with the loss of customary laws and weakening of local institutions, in favour of unsustainable management practices that prioritize rapid economic growth (Karst & Nepal, 2019). Depending on the context rapid modernization can either drive change in local institutions and culture (e.g. modernization gradually erodes traditional institutions and worldviews) (Jacquelin-Andersen, 2018; Karst & Nepal, 2019) or an outcome (e.g. eroded institutions and local culture allow modernization processes unchecked) (Gascón & Martínez Mauri, 2017; Sotomayor et al., 2019). In any case these processes can reinforce each other, and more often than not have major ramifications (usually detrimental) on traditionally managed indigenous landscapes and seascapes that are rich in biodiversity and natural resources (Etchart, 2017). Such phenomena are often concurrent with an increasing reliance on subsidies and government-led social programmes, having a compounding negative effect on the traditional social structures, norms and institutions related to ecosystem management that are the foundations of indigenous culture and idiosyncrasy (Karst & Nepal, 2019). Collectively all these mechanisms can reduce appreciably the resilience of Indigenous communities to environmental and socioeconomic shocks (Vaccaro et al., 2009). However, studies have suggested that strong Indigenous institutions and self-determination can act as a strong barrier against the negative effects of unchecked modernization (Patankar et al., 2016; Tang & Tang, 2010).

At the same time there have been rather divergent expectations over development outcomes between Indigenous groups and modernized societies (Buergin, 2015; Walsh-Dilley, 2013). Indigenous groups often seek to reap the benefits of modernization to improve their livelihoods, while preserving their autonomy, cultural integrity and freedom to self-determination (Newman, 2016; Walsh-Dilley, 2013). Many Indigenous groups want to develop their communities ‘under their own terms’ by balancing their traditional way of living while gaining access to new markets, rather than solely pursuing economic prosperity (Walsh-Dilley, 2013). This cautious attitude towards modernization and development initiatives, which are usually pushed by central governments and the private sector, has sometimes branded Indigenous groups as a barrier to development rather than a willing partner (Newman, 2016; Partridge, 2016). It has been suggested that strong Indigenous institutions can help achieve this notion of development under the own agenda of Indigenous communities (Patankar et al., 2016; Tang & Tang, 2010).

However, due to the unequal balance of power embedded in development and modernization processes, it is not uncommon to force development initiatives upon Indigenous groups, ‘coercing’ them in a way to modernize (Newman, 2016; Partridge, 2016). However, there is a widespread recognition of the importance to integrate indigenous needs and viewpoints during development and modernization processes (Zaidan, 2019). Many such attempts have failed because the perspective of Indigenous groups has been overlooked, leading to uneven development outcomes, increasing inequalities, social injustices and an overall marginalization (Partridge, 2016). It has been argued that in order to deliver effective development outcomes, Indigenous communities need to become active partners in development processes (Castillo, 2005; Opperman, 2013). It is in this context that strong Indigenous institutions can indeed address development challenges in a way that reflects the needs and sensibilities of Indigenous communities in a sustainable way by preserving their social–ecological systems (SES).

The Gunas are one of the Indigenous groups facing many of the challenges outlined above (De León Smith Inawinapi, 2016; Gascón & Martínez Mauri, 2017; Hoehn & Thapa, 2009; Orbach, 2004). They are one of the eight recognized Indigenous groups in Panama with settlements along the northeastern region of the country (Davis, 2014; Martínez Mauri, 2008). Their traditional way of life includes a governance system at local and regional level with institutions, structures and roles led by traditional authorities and leaders known as Saglas (Agar et al., 2015; Carlos Arenas, 2016) (see Section 2.2). Their socio-political system has a high degree of autonomy and self-organization through nested institutions that strongly reflect Guna values and is considered to be one of the best organized among Indigenous peoples globally (and a model for neighbouring Indigenous groups) (Orbach, 2004; Velásquez Runk et al., 2011).

The Gunas have been experiencing rapid development transitions. There are signs that some of the core Guna cultural values have been eroding due to exposure to western values and worldviews through tourism, the introduction of modern education and the different development aspirations of young Gunas after migrating in cities (Martínez Mauri, 2019; Orbach, 2004; Rawluk & Godber, 2011; Swiderska et al., 2009). Furthermore, traditional livelihood activities in Gunayala such as subsistence farming and fishing have been gradually replaced by formal economic activities related to tourism (Carlos Arenas, 2016; De León Smith Inawinapi, 2016; Gascón & Martínez Mauri, 2017; Martínez Mauri, 2018; Pereiro, 2016). While the Guna’s worldview, customary laws, traditional knowledges (TKs) and beliefs situate them as caretakers of nature adopting a lifestyle that preserves their SES, younger generations have started losing these traditional values (Alvarado, 1995; Chapin, 1994; Denniston, 1994; Rawluk & Godber, 2011; Swiderska et al., 2009). This disconnect has translated into the loss of customary laws for managing the SES, and especially managing natural resources, leading to their overexploitation and the degradation of ecosystem services (Alvarado, 1995; Orbach, 2004; Swiderska et al., 2009).

Yet, the actual outcomes of these development pathways seem to have been rather poor so far, with the Gunas registering among the highest multi-dimensional poverty index (MPI) levels and lowest human development index (HDI) levels in the country (UNDP, 2015). Despite the strong Guna institutions and representation in Panama’s legislative branch, there seem to be rather poor development outcomes due to the combined effect of the lack of nuanced attention to Gunayala’s needs (demonstrated by the predetermined type of support), remote geography, misunderstood worldview, frictions
with the national government over resource access and insufficient funding (Castillo, 2001; Orbach, 2004; Rivera Rosales, 2007). Furthermore, the cultural erosion from the loss of TK, practices and values has put further pressures in Gunayala’s SES.

Despite these rapid changes, there is very little literature studying Guna challenges in view of modernization processes and development trends (De León Smith Inawinapi, 2016; Gascón & Martínez Mauri, 2017). More broadly, although the inclusion of Indigenous peoples’ perspectives and TK has received ample attention in the current academic discourse (Appgar et al., 2015; Rawluk & Godber, 2011) including in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Díaz et al., 2016; Pascual et al., 2017), there is still a lack of robust research that seeks to understand what are the development concerns and aspirations from the Indigenous communities’ viewpoint (Jacquelin-Andersen, 2018; Rawluk & Godber, 2011).

This study aims to unravel the main development challenges of Gunayala and the factors mediating them through the perspectives of key actors and local Indigenous communities. Through a series of expert interviews and household surveys we synthesize their knowledge to illustrate how cultural, socioeconomic and environmental change has unfolded in the face of modernization processes and development aspirations, and what the implications for SES sustainability have been. The perspectives of the different actors provide different pieces of the puzzle to understand the interface of modernization, development and sustainability in Gunayala. Considering the few studies conducted for the Guna, here we bridge some of major knowledge gaps about the socioeconomic and environmental change in Gunayala brought by modernization, and the development challenges it gives rise to. More importantly, considering the strong institutions and autonomy that the Gunas have been able to maintain, here we show how some of the changes have emerged in Gunayala. This can help identify possible priority areas to strengthen in other Indigenous contexts characterized by efforts to either strengthen traditional institutions or prevent their further erosion, while avoiding sacrificing development aspirations and SES sustainability.

2 METHODS

2.1 Research approach

This study builds upon the Institutional Analysis Framework (IAD), which has been used to elucidate across different contexts the institutional and governance aspects of common pool resources (Blomquist & DeLeon, 2011; McGinnis & Ostrom, 2014; Ostrom, 2011). Some relevant applications include the study of Indigenous peoples’ management strategies and conservation efforts for common pool resources (Ayers et al., 2017; Mehring et al., 2011; Sanches et al., 2020).

A central element of the IAD framework is the concept of ‘action situations’ that denote the social space where actors interact to identify and tackle common problems. In this social space, contextual factors (in the broadest sense) influence the actions of multiple actors, and give rise to diverse outcomes, with the interactions between actors mediating these transformations and outcomes (McGinnis & Ostrom, 2014; Nigussie et al., 2018; Ostrom & Cox, 2010).

Figure 1 illustrates the conceptual framework underpinning this study. In this framework we identify three development processes (i.e. action situation) unfolding in Gunayala, namely social, environmental and governance processes. Each of these processes are outlined in Section 3.3 after eliciting information from experts and local communities (see Section 3.3 for synthesis, and Sections 2.3 and 2.4 for Methodology). These processes are influenced by a series of factors such as stakeholder interactions, livelihood transition, SES changes and traditional knowledges and practices erosion (see Section 3.2), and give rise to a series of perceived development challenges (i.e. outcomes) (Section 3.1).

The key development challenges (i.e. outcomes) that are perceived as priorities during development processes (i.e. the action situation) are elicited through expert interviews with the main local, regional and national stakeholders involved in development processes in Gunayala (Section 2.3). The development challenges are explained in more detail in Section 3.1. The exogenous contextual factors were initially identified through literature review and were subsequently confirmed by the expert interviews’ outcomes.

The study followed the ethical guidelines stipulated by the author's affiliated academic institution and recognized the free, prior and informed consent rights for Indigenous peoples. In particular given the high degree of autonomy in Gunayala (see Section 2.2), the permission to conduct research, the information allowed to be collected, and how this information was to be collected was approved by Guna institutions in accordance with local beliefs and ethics (e.g. not interview underage children, ask permission to take photographs inside private property). To obtain this permission, the research and all its related methodological aspects were explained to the Guna Cultural Congress (one of the highest regional Guna institutions) that is the body responsible for overseeing such activities. Permission was granted through multiple rounds of explanation and deliberation, which lasted for approximately 1 year. Without undertaking this iterative process to comply with local sensibilities when conducting research, it is not possible to receive the final permission document to enter Gunayala for research purposes.

Subsequently for community entry in the three study islands, we further communicated with both local and regional leaders explaining the research aim, the type of data been collected, and how the information will be used. Additionally, a report with the results of the expert interviews was presented to the regional and local chiefs prior to starting household surveys in the three islands. Each part of the research protocol was finalized through continuous communication with regional and local Guna authorities. Research objectives, type of information collected and participant privacy/anonymity were explained to each community sagla, authorities at the Gunayala Cultural and Administrative Congress through written...
communication and in person, and explained to each interviewee and surveyed participant in this study. Finally, verbal consents were obtained from participants before starting interviews and surveys to ensure they understood the research purpose, how the collected information will be handle and their rights to stop and opt-out of the study at any time during the expert interviews or household surveys. The verbal consent was purposely chose as part of gaining the community trust (see Section 2.4) and to ensure participants from all literacy levels fully comprehends their role and rights in the study.

2.2 Study sites

The Gunas account for 19% of the total Indigenous peoples in Panamá and 2% of the total national population (Velásquez Runk et al., 2011). Gunayala consist of 51 communities scattered mainly among the islands located in the San Blas archipelago. Of these 51 communities, two are communities of afro-descendants and are settled in the mainland, while the remaining 49 are Guna communities (38 settled in islands and 11 settled in the mainland). Gunayala is broadly divided into three districts (Dubwala, Agligandi and Nargana), each containing two leaders known as ‘Sagladummagan’. Land access to Gunayala is limited to a mountainous road that is only accessible with four-wheel drive cars. The road was opened in the 1970s as a dirt road, with paving starting since the early 2000s. Access to the island communities is done through motorboats and other vessels.

The Guna territory, known as ‘comarca’ is recognized by national law and was created in 1938 (‘Comarca de Gunayala’) and in 2000 (‘Comarca de Wargandi’) (Castillo, 2001; Hoehn & Thapa, 2009; Jacquelin-Andersen, 2018; Velásquez Runk et al., 2011). The Gunas have been enjoying full administrative and political autonomy from the national government since 1953 in these territories (Castillo, 2001; Davis, 2014; Orbach, 2004; Rivera Rosales, 2007).

The Gunas have been able to maintain strong institutions and a high degree of autonomy within Panama (Orbach, 2004; Velásquez Runk et al., 2011), and are identified as such compared to other Indigenous groups in the America (Dahl et al., 2020). Table 1 and Figure 2 outline the main Indigenous institutions of the Gunas. The base institution is the Local Congress. Each Gunas island community has its own Local Congress governed by community chiefs (known as ‘Saglas’) that guide and administer matters pertaining to their island and its nearby resources (Davis, 2014; Orbach, 2004). The Cultural Congress and the Administrative Congress are higher level regional institutions governed by the ‘Sagladummagans’. The Administrative
Congress is in charge of managing access to the region and engaging with the Panamanian government, while the Cultural Congress is responsible for preserving the Guna culture, beliefs, traditional knowledges and worldviews of their people. The General Guna Congress is the highest governing institution for the Gunas and convenes twice per year. It consists of representatives from the Local Congresses, Cultural Congress and Administrative Congress.

Figure 2 outlines the main linkages of the Guna institutions. All leaders (i.e. Saglas and Sagladummagens) are democratically elected respectively by community members and local congresses, and they have put in place a robust consultation process to approve any major development project that could impact their SES.

The primary livelihood sources in Gunayala are tourism, agriculture and fishing (Orbach, 2004; Rivera Rosales, 2007; Velásquez Runk et al., 2011). The region is characterized by lower development compared to the rest of the country. For example, while in 2014 the national Human Development Index (HDI) was estimated as ‘High’, it was estimated as ‘Low’ for Gunayala, with each dimension (i.e. life expectancy, education, and income) being among the lowest in the country (UNDP, 2015). The national multi-dimensional poverty index (MPI) stands at 14% (‘Low Poverty’), while for Gunayala stands at 82% (‘Highly Poor’) (UNDP, 2015). The highly disproportional HDI and MPI levels are further aggravated by the loss of capable workforce, as emigration has increase by 36% between 2000 and 2010, mostly young males above 25 years searching for better income opportunities in cities (Quintero, 2004; UNDP, 2015). As a result, Guna’s population in Gunayala decreased by 3%, while it increased by 62% outside their territories (Instituto Nacional de Estadística y Censo (INEC), 2010, Davis, 2014).

### Table 1 Main Indigenous institutions in Gunayala.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Description</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Guna Congress (Onmaggeddummad Sunmaggaled)</td>
<td>Highest ruling body in Gunayala. It is the recurring gathering (twice per year) of Gunayala’s leaders, composed of Cultural Congress, General Congress, and representatives from the local congress of each community</td>
<td>Regional institution. Approves and monitors development projects. Protects and manages Gunayala’s resources (public and private)</td>
</tr>
<tr>
<td>Cultural Congress (Onmaggeddummad Namaggaled)</td>
<td>Highest cultural authority in Gunayala. It oversees Gunayala’s cultural heritage and worldviews</td>
<td>Regional institution. Provides guidance to the local congress of each community</td>
</tr>
<tr>
<td>Administrative Congress (Onmaggeddummad Sunmaggaled)</td>
<td>Highest administrative authority. It oversees Gunayala’s political and administrative tasks</td>
<td>Regional authority. Allocates Gunayala resources (i.e. income from tourism) based on the General Guna Congress. Regulates access to Gunayala. Communicates indigenous issues with the Panamanian Government</td>
</tr>
<tr>
<td>Local Congresses (Neggwebur Onmagged)</td>
<td>Highest authorities within each island. They oversee the cultural, political and administrative task in each individual community</td>
<td>Community-level institutions. They enforce the General Guna Congress decisions, while addressing their community needs. Individually they have a high degree of saying in the regional institutions mentioned above</td>
</tr>
</tbody>
</table>

Source: Adapted from Congreso General Guna (2013).

2.3 | Data collection and analysis

2.3.1 | Expert interviews

We conducted 31 expert interviews with national- and local-level stakeholders between February and March 2018. The expert interviews were selected through a stakeholder analysis that identified...
the main organizations related to Gunayala’s development using the main policy documents related to the Gunas in Panama. The expert interviewees represent the main organizations and agencies at the national level relevant to Gunayala’s development (10 experts), and eight experts from development agencies and NGOs who work in Gunayala. Furthermore, we interviewed 14 local experts such as the Guna Cultural Congress (highest authority in charge of preserving Guna’s identity), and the chiefs and other

FIGURE 2 Relations of main Guna Institutions.

FIGURE 3 Study sites in Gunayala (highlighted in green).
relevant organizations/experts in the study islands (Section 2.2). Table S1 provides the full list and affiliations of respondents, and Section 2.4 outlines how the authors obtained access to Gunas expert respondents.

The expert interview protocol consisted of modules seeking to understand Gunayala’s development challenges and the four influencing factors based on the study conceptual framework (Figure 1). The modules were: (a) Gunas worldview, traditions, beliefs and TK, (b) livelihood activities and agricultural production, (c) key resources in the Gunayala and their values (following Díaz et al., 2016; Pascual et al., 2017; TEEB, 2010), (d) stakeholder interactions, local institutions and self-organization in Gunayala (following Ostrom, 2009) and (e) key development challenges in Gunayala. The results of the stakeholder interactions module helped to identify additional relevant stakeholders for further expert interviews.

Each interview lasted on average 1h. All interviews were conducted in Spanish, apart from two interviews that were conducted in gunagaya (Guna language). During these two interviews an interpreter familiar with the research provided simultaneous translation (see Section 2.4 for more details). All interviews were digitally recorded and transcribed to facilitate the coding for the content analysis (see below). Codes were defined based on responses and framed to achieve a balance between a general understanding of the issue (e.g. education challenges) and avoiding a granularity level where no patterns exit. To ensure consistency the coding was conducted manually solely by the corresponding author using programing custom functions and macros in Excel to keep track of similar references between interviews.

The outcomes of the content analysis identified the individual development challenges in Gunayala and the trend of each challenge (see below and Section 3.1). Subsequently the major development challenges were critically identified after grouping and aggregating individual challenges across categories based on similarity, and are represented in a dendrogram. In this sense the individual and major challenges were elicited through the coding and critical analysis of the expert interviews, and did not reflect any preconceived notions from the side of the research team or the adopted conceptual framework.

The trends of these challenges were captured in each expert interview according to the perspective of the respective expert interviewee through a 5-level Likert scale (1 =degrading, 2 =somewhat degrading, 3 =same, 4 =somewhat improving and 5 =improving).

The consensus between respondents was estimated through a consensus value, denoting the level of agreement over these trends between interviewees, ranging from a value of one (‘1’) representing full consensus to a value of zero (‘0’) representing complete disagreement and denotes a dispersion among respondent’s answers (Taste & Wierman, 2007).

The interactions between stakeholders (Section 3.2.1) were mapped to identify possible bottleneck and sources of delays/conflicts between Gunas and other institutions. In particular we map three types of interactions between stakeholders, namely (a) funding flows (i.e. money that were either provided directly to the institution or indirectly through an intermediary agency or trust fund); (b) policy flows (i.e. regulations, sanctions, bans and self-regulations of formal and informal institution); and (c) service flows (i.e. consultancies, government-related social programmes, health and education projects). A complementary matrix highlights the average quality of these interactions as perceived by the respondents, as well the source and recipient of each flow among stakeholders. The quality of interactions seeks to capture the satisfaction level and collaboration effectiveness of such flows and was coded through a 3-level Likert scale (1 =weak interaction, 2 =neutral satisfaction and 3 =strong interaction).

2.3.2 Household survey

We conducted household surveys in the three Gunayala islands (Figure 3). The design of survey questions was informed by the expert interviews, and particularly by the content analysis outcomes (i.e. what proxy variables can be used to understand tradition, culture and TK changes). The surveys contained questions about (a) respondent characteristics, (b) income and livelihood activities, (c) benefits derived from the SES and (d) traditional knowledge and practices. Section 2.4 explains in depth the measures taken to ensure proper community entry and that the household survey questions were both understandable to respondents and reflected their needs.

Overall, 232 household surveys were conducted, capturing on average 14% of the target population in each island (see Table 2). We targeted four distinct study groups divided across sex and age (see Table S2). This is because we expect that distinct values and value changes are linked to both age and gender. For example, expert interviews suggested the more pronounced loss of traditional values among the youth, and an expected responsibility to preserve traditional values through gender roles (i.e. women maintaining Guna culture through traditional clothing and traditional dishes) (Guna Cultural Congress, personal communication, 16 February 2018).

Age groups are divided between ‘adult’ and ‘young’, with the latter being closer to the concept of millennials. This group essentially reflects the generation that has been in closer and more frequent contact with western culture and values through the tourism generated by the better road access from the early 1990s. Hence, we use the threshold of ‘29 years old and below’ to define the young age

### Table 2 General characteristics of study islands.

<table>
<thead>
<tr>
<th>Community</th>
<th>Gardi Sugdub</th>
<th>Soledad Miria</th>
<th>Nargana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population†</td>
<td>927</td>
<td>896</td>
<td>1215</td>
</tr>
<tr>
<td>Adult Population†</td>
<td>563</td>
<td>459</td>
<td>690</td>
</tr>
<tr>
<td>Development Progress‡</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Cultural/TK Condition‡</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

† Panama 2010 Census.
‡ Expert interviews.
group. All respondents were above 18 years old to avoid triggering local community sensitivities about research targeting children.

To ensure the random sampling of each group, we use satellite images of each community. Each household was assigned a unique number using QGIS version 3.4.4 that allowed us to run a random function in Excel to select both the household to visit and which of the four groups to survey (see Figure S1). In each household respondents were selected following a protocol to avoid any subjective decision from the local enumerator (i.e. what to do in case of multiple possible viable interviewees). The surveys were conducted between March and April 2019 through local enumerators from each island. The enumerators were hired and trained at each island to mitigate concern regarding research motivations and generate trust among respondents and local authorities.

The Results section elicits the main elements of the SES (and the associated ecosystem services) that are important to the local Guna communities. Based on insights from the expert interviews we group them in three main categories, namely geographical elements, natural resource elements and cultural elements. We elicit the perceived (a) current availability through a 3-level Likert scale (1 = Scarce, 2 = Reduced and 3 = Sufficient), and (b) expected future availability if no further changes are introduced in the SES through a 5-level Likert scale (1 = Degrade, 2 = Moderately degrade, 3 = Stable, 4 = Moderately improve and 5 = Improve). The overall trend for each SES component is calculated as the average of responses from the expert interviews. Subsequently, we elicit the multiple values associated with each of these SES elements for each study group following the distinction between bequest, instrumental, relational, intrinsic, existence and option values (Díaz et al., 2016; Pascual et al., 2017; TEEB, 2010). These values were elicited through a multiple-choice question that contained the local interpretations of each value. These local interpretations were extracted from the expert interviews including experts from the Guna Cultural Congress and Saglas (local chiefs). A 10-level Likert scale was used to elicit the importance of each SES element (1 = Not important, 5 = Neither important nor irrelevant and 10 = Very important), with the values presented as the percentage of total respondent that perceived those values.

Section 3.2.4 elicits differences between groups in terms of the loss of traditional values. We capture the exposure to nonlocal practices and the active engagement in traditional practices deemed as essential to preserve the Guna identity. These proxy indicators were identified through the expert interviews. Each respondent self-reported their exposure to nontraditional elements (i.e. social media, tourist) through tailored 5-level Likert scale questions (Table S3). The overall trend for each group for each value is calculated as the average of responses between all survey participants.

The comparisons between age groups (Sections 3.2.2 and 3.2.4) were conducted through inferential statistics using SPSS version 23. The Mann–Whitney test was used for the age group comparison, and Kruskal–Wallis test for the four-group comparison. Complementary comparisons between islands are provided to outline TK and value degradation. However, they are not the focus of the study, and are therefore not discussed extensively in the text (Table S4).

2.3.3 Visualization and dissemination

Due to length limitations only the most important patterns are explained in the Results section. To facilitate the dissemination and appreciation of the results to a broader audience, and enhance their visualization, a dashboard was created using Microsoft’s Power BI analytics service. The dashboard allows users to customize the parameters deemed important based on their needs and interests. For example, the expert interviews suggested that different stakeholders have different information needs, for example, NGO targeting females versus academics seeking to understand value changes between age groups.

The dashboard includes three different filtering options that dynamically adjust the rest of the information. The filtering options are (a) ecosystem services, (b) SES component and (c) general survey characteristics. The different selections based on the individual user’s interests will affect the three main areas of information provided by the dashboard, including (a) the description of the selected resource, (b) the availability and trend of the resource and (c) the multiple values perceived by the community.

Figure S6 offers a quick presentation of the main features of the dashboard. Access to the dashboard is free of charge through this link: https://rdamlam.wordpress.com/gunayala/.

2.4 Engagement with Indigenous authorities and community entry

As mentioned in the previous sections the data collection was overwhelmingly based on information from Gunas, whether experts (Section 2.3.1) or island residents with different demographic characteristics (Section 2.3.2). Considering the strong degree of autonomy in Gunayala, we followed a series of steps to gain access to (and the trust of) Guna expert interviewees and local communities.

We first developed a relationship with the Indigenous People Office of the University of Panama (OPINUP), whose mission is to bridge the gap between the needs of Indigenous Peoples and the University of Panama. While at the time of this research all OPINUP members were Gunas, they work towards addressing the needs of all eight Indigenous groups in Panama. OPINUP members facilitated introduction with the Guna Cultural Congress to obtain the permission to conduct research in Gunayala (Section 2.1).

For the expert interviews at the national level, OPINUP members introduced the research team to all of the Guna expert interviewees, thus cultivating an atmosphere that this research is relevant for the Gunas. In fact, the research team organized directly only interviews with international agencies (i.e. FAO, Spanish Development Agency, Inter-American Development Bank). Beyond these introductions, an OPINUP member was present in each of the interviews with Guna experts. This further helped create an environment of trust and facilitated when needed the translation of terms to the local language. For expert interviews at community level, we approached a local community leader that acted as our local research guide in the
three study islands. This local research guide has been very active in Gunayala’s governance systems (serving previously in the Guna Administrative Congress), with also prior experience working with international researchers and a strong network with community members (including community chiefs). He facilitated the organization of expert interviews with community chiefs at each study site, and with other relevant community leaders. To further demonstrate our respect to the Guna authorities the first expert interview at each location was held with the highest Guna authority in that locality (i.e. Cultural Congress general secretary, community chiefs).

Through the above processes we also gained entry in the study communities to conduct the household surveys. Overall, the household surveys were designed using insights from the expert interviews in order to reflect the needs and concerns of the Gunas. We followed four steps to ensure that the questions within the household survey made sense, and were phrased appropriately to be understandable to the local communities. The first two steps were conducted before the fieldwork, and the last two steps were performed during the fieldwork.

First, we conducted a working session with OPINUP members to go through the first draft of the household survey to ensure that the terms were correct, and that the questions were clear and understandable to local communities. As mentioned above, OPINUP members were Gunas and thus had a good understanding of the local context. Second, the questionnaire was pretested prior to the fieldwork. After each pretesting survey, we had a quick interview between 20 and 30 min to ask respondents whether the terms and questions were clear and relevant. However, in anticipation of the permission this pretesting was conducted in Panama City with visiting Guna community members and Guna college students temporarily relocated to the city for their studies. Therefore, this pilot was limited to a sample size of approximate 10 surveys, with the results not used for further analysis. Third, the first day of the fieldwork at each study island was dedicated to train enumerators and validate that the questions and terms within the survey were understandable. All enumerators were hired locally in each island and were Guna residents in the specific islands. Fourth, the first surveys at each study site were conducted with the presence of the entire team, comprising of the corresponding author, an OPINUP member, the Guna local guide (see above) and all local enumerators. This was done to ensure that the survey was being performed as intended in terms of being understandable and eliciting properly local perceptions/knowledge. During these joint sessions we gathered reactions, feedback and concerns from community members for final revisions of the survey if needed.

2.5 Study limitations

Despite its comprehensive lens and robust design, this study has four major limitations in terms of: (a) the reliance on perception questions to elicit changes in SES elements and ecosystem services (Section 3.2.3), (b) the limited number of study islands and expert interviewees, (c) possible biases and inability to comprehend certain Gunas realities due to the cultural origin of the research team and (d) the overall conceptual and methodological lens used in the study.

Regarding the former, it has been suggested that self-reported perceptions for ecosystem services might not reflect well the actual change, especially for services that cannot be observed easily such as some regulating and supporting services (Boerema et al., 2017; Larson et al., 2019). However, given the strong connection of the Gunas with their SES, we believe that perception questions can be rather accurate in this context. In any case, it would be advisable for future studies to validate these results through a more comprehensive ecosystem service assessment for Gunayala.

Second, in order to compensate for the limited number of studies sites we selected islands that represented a comprehensive gradient of development versus tradition (Section 2.2). This allowed us to achieve a rather comprehensive cross-section of islands for our study. Finally, we believe that the number of expert respondents was sufficient for this type of analysis, as the saturation analysis we conducted suggested that halfway the interview process over 95% of the challenges were identified (Figure S7).

Third, although the corresponding author is Panamanian, none of the authors are Guna or from another Indigenous group. This raises the possibility of cultural biases or a lack of reflexivity (Kwame, 2017), leading to research questions or outputs that might not represent Gunas’ reality. To minimize possible biases the study relies on a robust mixed-method research approach, where each step of the study is informed by evidence gathered from the previous steps, with Gunas being the main sources of information. For example, household surveys were designed based on multiple interviews with experts, most of which were Gunas that understood well local views and context (Table S1). Moreover, comprehensive research protocols were put in place to ensure that the research tools were sensitive to the local context, and able to reflect the needs of (and be understood by) local communities. The main such actions as outlined in Section 2.5 included: (a) pretesting household surveys and iteratively confirming relevant terms, content and phrasing with Gunas enumerators and assistants; (b) conducting the expert interviews in the presence of Guna collaborators and conducting the household surveys with local enumerators; and (c) positioning ourselves at multiple roles (through a reflexivity process), as outsiders, fellow citizen and researchers to become recipients of knowledge from these perspectives (Kwame, 2017).

Fourth, and partly relevant to the previous point, we acknowledge that a significant fraction of the literature focusing on change in Indigenous SES comes from Indigenous studies. Here, we opted to follow instead a data-driven approach that emphasized on the gradual elicitation of empirical information through a robust mixed-method approach. We believe that although there is some likelihood of cultural bias as outlined above, it has been minimized to the extent possible. That said we believe that the findings of this study are well informed and elicited in a robust manner, and can thus provide much needed information for the challenges facing the Gunas (a rather understudied Indigenous group), as well as contribute to the much needed interdisciplinarity to approach the study of Indigenous SES.
3 | RESULTS

3.1 | Development challenges

Interviewees collectively identified 55 different development challenges, aggregated in four main areas of concern, namely development impacts, environmental impacts, governance constraints and social impacts (Figure 4). The ‘development impacts’ cover issues related to livelihoods, standard of living, health and education. The ‘environmental impacts’ cover issues related to the negative environmental outcomes from the increase pressures to ecosystem services. The ‘governance constraints’ reflect the need to formalize Guna governance processes, boost capacity-building, strengthen local institutions, enforce laws and regulations, and improve the cooperation between key actors engaged in Gunayala’s development. As one respondent aptly explained: ‘[...] we are getting funds, but [we] do not know how to allocate [these funds], [how to] manage it, there is where the friction comes [from], between communities, [because] there are no formal reports [...]’ (Gardi Sugdub Local Researcher, personal communication, 12 March 2018). The ‘social impacts’ cover issues that affect Guna’s cultural identity, beliefs, worldview and community cohesion.

While the ‘development impacts’ contain the highest number of challenges, the ‘social impacts’ carry the biggest concern among the

FIGURE 4 Main development challenges elicited from expert interviews.
Gunas. As one respondent described: ‘[…], the young generations are losing their Guna identity, they are shy [apprehensive] to learn, they want to be waga [non Guna, westerner], that is why is fundamental to reinforce our identity, our traditional knowledges’ (Gardi Sugdub Sagla, personal communication, 12 March 2018). This is implied by higher frequency of issues reported under the ‘social impact’ theme, which reflects the comparatively higher concerns over the loss of social cohesion (Figure 5). Figures S2–S5 provide a more disaggregated view of the patterns among all of the individual 55 development challenges.

### 3.2 | Factors intersecting in Gunayala’s development processes

#### 3.2.1 | Stakeholder interactions

Figure 6 shows the flows between the different actors involved in Gunayala’s development. Despite the extensive service interactions (e.g. through consultancies, education/health programmes, capacity-building), there are few interactions related to funding between stakeholders engaged in Gunayala’s development (Figure 6).

#### Challenges

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Trend</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development (n=20)</td>
<td>92</td>
<td>2.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Environmental (n=4)</td>
<td>27</td>
<td>2.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Governance (n=15)</td>
<td>52</td>
<td>2.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Social (n=16)</td>
<td>116</td>
<td>1.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>

= Degrading  
= Somehow degrading  
= Same  
= Somewhat improving  
= Improving

Figure 5 Main development challenges by theme. ‘n’ denotes the number of different issues reported in the interviews; ‘frequency’ represents how many times those issues were reported by interviewees.

Figure 6 Diagram of the main stakeholders relevant for Gunayala’s development and the types of interactions between them.
Stable funding sources are essential for developing critical health and education infrastructure, manage natural resources and enforce regulations across Gunayala. The limited economic support to sustain Gunayala’s institutions and drive the development agenda has prompted income from tourism as a crucial industry to ensure Gunayala’s development autonomy. For example, according to an expert ‘[…] the decentralization law assigns a budget and grants expenditure autonomy to each province except in Gunayala […], it has been 100 years without financial resources from the national government […], therefore what we have done is to charge Panamanians and foreigners a $20 tax in our territory to have economic resources’ (Young Guna Civil Society, personal communication, 2 March 2018).

Figure 7 captures a matrix showing details regarding the quality of the interactions shown in Figure 6 between the different actors. The matrix conveys how receiving actors (‘To’ column) perceived the interaction from the providing actor (‘From’ column). Despite the multiple interactions between national government institutions and both regional and local Guna groups, there is a lack of interaction between national government institutions to address issues in Gunayala through comprehensive programmes across cross-cutting issues (Figure 7). This lack of interaction and coordination between stakeholders is described by an expert: ‘[…] the national commission of traditional medicine requires by law that all ministries must be part of the working group, they never appeared, they [ministers] don’t care, so the ministry of health told us, let’s go ahead [without the other ministries]’ (Guna Cultural Congress, personal communication, 2 March 2018).

3.2.2 | Livelihood transitions

When looking at the main livelihood activities captured from the household survey, results suggest that adults have a significantly higher income from government social programmes compared to younger Gunas, largely due to a development programme targeting retired citizens (over 65 years) (Table 3). According to experts this programme has generated both positive and negative outcomes, with some pointing improved food access through food purchases (CONAMUIP, personal communication, 24 February 2018), and others pointing the negative effects on agricultural production as it has ‘incentivized’ capable working Gunas to abandon agriculture on what is perceived as an arbitrary threshold of retirement ‘[…] 65 is young, they [the Gunas] don’t want to work the land anymore, they are just waiting their $120 USD, that’s the problem […] these programs are not based on our reality’ (Guna Cultural Congress, personal communication, 16 February 2018).

Overall males tend to be more engaged in traditional activities directly related to ecosystem services from the SES such as agriculture and fishing, while women are largely involved in household activities (Table 3). Younger Guna males are predominately involved in tourism activities and paid jobs (e.g. banks and other services), compared to adults (Table 3). This new livelihood activity has triggered social changes in Gunayala, where communities are shifting from a traditional subsistence lifestyle to an economy-based system ‘[…] in the past, Gunayala has never depended on tourism, this is a new thing, we have always depended on agriculture […] now everything is tourism, since the income is significant, now everything is about income and has reshape even our governance structure’ (Panama Tourism Authority Officer, personal communication, 16 February 2018). Females are also involved in tourism activities through the production of art and craft, albeit to a much smaller extent than young males (Table 3).

3.2.3 | Changes in SES and its ecosystem services

The main elements of the SES that are important to Guna communities provide different types of ecosystem services, mainly provisioning and habitat/supporting (Figure 8) and are associated
with different values (Tables S5 and S6). Yet it is important to note that many of the elements also provide cultural ecosystem services, further suggesting the strong linkage of Guna culture with the SES. When looking at the values associated with these SES elements results were consistent between sampling groups. Overall, there is a strong sense of relational value attached to cultural SES components including their homeland and sacred places (galus) for both young and adult Gunas (Table S5). These sacred places often serve as customary protected zones for key marine species and forest products ‘we have sacred resources, we called it galu, they should not be use, they must be protected’ [...]

with Gunayala’s development (Figure 8). For example, even though lobsters were widely available in the past and consumed by Guna households, they have experienced a significant decline in availability in recent years. The access to new markets and the increase in tourism, both associated with development, have triggered an overexploitation of lobsters ‘[...] tourism brings both positive and negative things, so younger generations have their own vision, they see things in an economic way, they sell the lobster, all is about the money, they have loss the solidarity with the Guna society’ [...] (Gardi Sugdub Sagla, personal communication, 12 March 2018). Coral reefs have also experienced significant degradation in the study area, through their extraction as raw materials for land reclamation and coral bleaching. Interviews with local experts imply that coral reef loss has triggered shifts in fish stock location, marine biodiversity loss and flood risk increase as reefs are natural barriers against storms that have increased their intensity in recent years (Gardi Sugdub Marine Biologist, personal communication, 12 March 2018).

Table 3: Main livelihood activities for entire sample.

<table>
<thead>
<tr>
<th>By age group</th>
<th>By age group and sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>Young</td>
</tr>
<tr>
<td>General characteristics</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>116</td>
</tr>
<tr>
<td>Age (avg.)</td>
<td>49</td>
</tr>
<tr>
<td>Years Education (avg.)</td>
<td></td>
</tr>
<tr>
<td>Income (USD)</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>139</td>
</tr>
<tr>
<td>Tourism</td>
<td>27</td>
</tr>
<tr>
<td>Transport</td>
<td>7</td>
</tr>
<tr>
<td>Craft</td>
<td>11</td>
</tr>
<tr>
<td>Fishing</td>
<td>10</td>
</tr>
<tr>
<td>Agriculture</td>
<td>13</td>
</tr>
<tr>
<td>Paid Job</td>
<td>53</td>
</tr>
<tr>
<td>Remittances</td>
<td>12</td>
</tr>
<tr>
<td>Others</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>297</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main activities</th>
<th>By age group</th>
<th>By age group and sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household</td>
<td>62 (53%)</td>
<td>47 (41%)</td>
</tr>
<tr>
<td>Student</td>
<td>1 (1%)</td>
<td>15 (13%)</td>
</tr>
<tr>
<td>Agriculture</td>
<td>23 (20%)</td>
<td>13 (11%)</td>
</tr>
<tr>
<td>Tourism</td>
<td>5 (4%)</td>
<td>22 (19%)</td>
</tr>
<tr>
<td>Art Crafting</td>
<td>9 (8%)</td>
<td>5 (4%)</td>
</tr>
<tr>
<td>Paid Jobs</td>
<td>14 (12%)</td>
<td>13 (11%)</td>
</tr>
<tr>
<td>Fishing</td>
<td>16 (14%)</td>
<td>21 (18%)</td>
</tr>
<tr>
<td>Transport Industry</td>
<td>2 (2%)</td>
<td>4 (3%)</td>
</tr>
</tbody>
</table>

Note: For details by island see Table S4. Abbreviations: AM, adult men; AW, adult women; YM, young men; YW, young women.

*p < 0.05; **p < 0.01; ***p < 0.001.
3.2.4 Loss of traditional knowledges and practices

Overall younger Gunas have a lower knowledge and engagement in traditional practices and a higher exposure to non-Guna worldviews (Table 4). For example, younger Gunas tend to travel more often to cities and have more frequent interactions with wagas (non-Gunas) compared to adult Gunas. Young Gunas also have a significantly higher exposure to media (M = 4.4 h/day) compared to adults, which has both positive and negative effects. On the one hand, it can be an educational tool and a valuable source of information (Nargana Sagla, personal communication, 13 March 2018), but on the other hand, it can decrease engagement in community activities and possibly erode social cohesion. For example, one of the expert interviewees stated that ‘[…] the issue [Guna governance] I see is that the youth is not stepping up to the task, because of the internet, the modern amenities, there is an apathy […]’ (Protected Area Director, personal communication, 16 March 2018).

Furthermore, younger Gunas tend to have a significantly lower knowledge of traditional practices such as traditional medicine and other traditional ceremonies (Table 4). Despite the fact that preserving traditional practices such as traditional Guna medicine is highly regarded/value in the community, younger generations rather use and pursue western medicine (Regional Head Ministry of Health, personal communication, 19 February 2018). Moreover, according to experts, western medicine is often depicted as sign of progress by the education system in Gunayala, that is, ‘[…] traditional medicine doesn’t pay well […] they will rather become a doctor and have a stable salary […]’ (Vice Ministry of Indigenous Affair, personal communication, 20 February 2018).

3.3 Gunayala’s development action situation

3.3.1 Social action situation arena

The current social change amidst the recent economic development is of growing concern to Guna communities and other stakeholders. This is particularly evident in the succession of events catalysed by the economic transformation brought about through the increased communication with nonindigenous societies, centred on trade and tourism. These economic transformation processes have triggered shifts in traditional livelihood activities and eventually caused major social changes in Gunayala. According to the expert interviews, the construction of new road infrastructure was intended to improve Gunas access to new markets for exporting excess agricultural and artisanal fishery products (Guna Cultural Congress, personal communication, 16 February 2018). However, these trade expectations did not fully materialize. Instead, the road infrastructure served as the avenue for a tourism surge in Gunayala, eventually constituting a major income source especially for the younger generation (Table 3). At the same time the social protection plans and stipends provided to older community members have become disincentives to engage with traditional livelihood activities (see Section 3.2.2).
Collectively these processes have altered traditional livelihoods based on subsistence agriculture, contributing to certain negative outcomes to the local food system exemplified by the decline of local food production, loss of regional staple food and diet changes to western products. As mentioned above subsistence agriculture has declined as many young and old Gunas, as the former prefer to engage in the more lucrative tourism sector, while the latter have fewer incentives to engage in hard agrarian work due to the monthly stipends received through social protection plans. This has major multiplier effects for Guna’s society, including TK transmission, social cohesion, higher dependence on imported food, increased risk of noncommunicable diseases and waste generation (i.e. cans, plastic bottles) (Figures S2 and S5). Furthermore, alongside such value changes there is the concurrent emergence of social problems associated with the individualistic lifestyle, such as intra-household conflicts, petty theft and drug abuse (Figure 4; Figure S5).

### 3.3.2 Environmental action situation arena

The population growth in the confined space of the small islands inhabited by the Gunas has started putting substantial pressure on the SES, especially through the unsustainable extraction of natural resources (Figure 8; Figure S3). For example, tourism has become the main source of pressure for important local resources such as lobsters (see also Hoehn & Thapa, 2009, Rawluk & Godber, 2011 for further information). While the attempts to regulate lobster harvest during the mating season have been mostly successful (Vice Ministry of Indigenous Affair, personal communication, 20 February 2018), there are still many challenges to overcome (see next section). Furthermore, the increasing generation of nonorganic waste degrades local mangroves that are increasingly used as dumpsters (Gardi Sugdub Marine Biologist, personal communication, 12 March 2018). At the same time coral reefs are extracted for land reclamation to cater for the growing island population in these small islands, having knock on effects on fish stocks and buffering against storm waves. Finally, the remote location of Guna communities, combined with limited transport access, increases their vulnerability to climate change (see also Apgar et al., 2015; Elmer, 2012; Leaness, 2017 for further information). The increasing frequency and duration of storms means that local communities are cut off more frequently and for longer periods from the mainland, and essentially from their food supplies (see Dam Lam et al., 2023 for a more detailed explanation of the underlying mechanisms).
3.3.3 Governance action situation

Even though the current governance system is strong and gives large autonomy to the Gunas (Sections 1 and 2.2), as explained below it can complicate (a) the enforcement of regulations and (b) hamper large development projects.

Regarding (a), regulation enforcement (especially environmental) is quite challenging in the region due to the large extent of the marine area that must be monitored, particularly in view of the limited available resources. Moreover, while most communities follow the regulations defined through the Guna General Congress, each local chief (‘sagla’) can decide to overlook the enforcement of regulations such as marine resource harvesting controls (Gardi Sugdub Marine Biologist, personal communication, 12 March 2018). Overall, our results suggest that there are real challenges in the enforcement of environmental regulations due to the combined effect of limited communication capabilities, difficult transport access, scarce funding and lack of technical training/capacity.

Regarding (b), large development projects and programmes that target the entire region, subregions or multiple communities can take a long time to materialize. Indeed, the final decisions of the General Guna Congress to proceed with a given project can sometimes take years (Protected Area Director, personal communication, 16 March 2018). This is because the Guna governance structure requires consultations at multiple levels before allowing the implementation of new development interventions (Section 2.2, Table 1). The extensive consultations process and the lack of introducing new interventions is highly regarded among Gunas since it allows every opinion to be accounted for (and ponder the impact of interventions carefully), but it also limits the ability to respond quickly to rapidly evolving issues (Figure S4). Moreover, there is a lack of technical capacity among Guna leadership to respond effectively to the emerging undesirable social and environmental impacts of development, which is gradually becoming a real concern to the local Guna communities (Figure S2). Even though there is a new generation of trained Guna professionals capable of managing Gunayala’s natural resources, they prefer to migrate to cities and seek out higher paid jobs, which creates a local technical capacity vacuum.

The above issues are compounded by broader chronic governance challenges such as bureaucracy, limited capacity and funding constraints that further complicate Gunas’ ability to respond to the current change caused by modernization processes and emerging development priorities (Section 3.1).

4 DISCUSSION

4.1 Navigating the interface of modernization, development and sustainability in Indigenous contexts

Indigenous peoples face a myriad of challenges in their development journey (Apgar et al., 2015; Jacquelin-Andersen, 2018). Similar to other Indigenous settings, the Gunas are currently seeking to navigate the tricky waters of modernization, development and sustainability. Despite the rather unique characteristics of Gunayala outlined throughout this study, and especially considering their strong institutions (Section 2.2), some parallels can be drawn with other Indigenous contexts, especially where tourism has become the primary mechanism for socioeconomic transformation.

Similar to the Gunas the tourism industry has diversified income and livelihoods in many indigenous settings (Leu, 2019; Sotomayor et al., 2019), but also caused unintended cultural and social erosion (Section 3.3.1). The transition from subsistence to formal economic activities (Section 3.2.2) has had in many areas replaced traditional practices, skills, knowledge and governance systems (see also Movoño et al., 2018; Sotomayor et al., 2019). However, similar to the Gunas (Section 3.2.3) despite such changes several Indigenous groups have managed to preserve their sense of belonging and connection with their surroundings (Zen et al., 2020).

Although appealing to certain parts of the Guna communities the current development and modernization processes have had unintended effects in the Guna society through livelihood changes (see Section 3.2.2). This has been observed in other indigenous settings (Guillaume & Thill, 2018; Hay, 2013; Movoño et al., 2018). The subsequent lifestyle and dietary changes often have a negative effect on local food production and health (Jacquelin-Andersen, 2018; see Section 3.3.1; see Dam Lam et al., 2023 for a more detailed explanation). Moreover, since local food production is both reliant on and plays an important role for the preservation of TK and cultural traditions, the unintended consequences can be even more multi-dimensional, permeating the entire indigenous sociocultural system, as has also been witnessed elsewhere (Alvarado, 1995; Castillo, 2005; Saito et al., 2020) (see Dam Lam et al., 2023 for more details).

Our study clearly shows how shift from subsistence farming towards the tourism industry has prompted cascading lifestyle changes for many community members. This has created an interesting situation. On the one hand there is still a strong connection with their ancestral land and natural resources across all group ages (see Table S5), largely due to the strong Indigenous institutions. On the other hand there is still an ongoing development trend that is at odds to the Guna values, but is still appealing to different segments of the Guna society that have been evolving along the development journey through shifts from predominately subsistence-based and community-oriented livelihoods to more individualistic and formal economic activities. Such cascading effects have been witnessed in many different Indigenous settings around the world (Orbach, 2004; Sotomayor et al., 2019; Swiderska et al., 2009), as well as similar development problems are documented as offshoots of socioeconomic change (Castillo, 2005; Quintero, 2004).

4.2 Emergent dysfunctionalities in the context of strong Indigenous institutions

The dysfunctionalities and challenges mentioned above might come as a surprise, considering that the Gunas have been identified as a...
model for other Indigenous communities considering their strong institutions and large autonomy, which are usually perceived to be strong barriers to the negative aspects of unchecked modernization processes (ApGar et al., 2015; Karst & Nepal, 2019) (see also Section 1). In this growing call and concerted efforts for the better self-determination for Indigenous communities in many parts of Latin America (Jacquelin-Andersen, 2018; Tockman et al., 2015) and beyond (Patankar et al., 2016; Tang & Tang, 2010) it is useful to identify some of the more critical factors to prevent of mitigate similar challenges.

Arguably, in our opinion, the dysfunctional situation outlined above essentially emerges from the conflicting expectations between the national government and local communities over the most appropriate development pathway. On the one hand, the national government seeks to promote projects that would accelerate the country’s economic growth. On the other hand, the Gunas have a clear and unified voice of what development outcomes they seek to achieve thanks to the exhaustive and iterative consultation process between their local and regional institutions (Figure 2), which might sometimes require multiple iterations until consensus is reached. The Gunas are far more concerned in keeping their sovereignty and limit the possible environmental burden of the accelerated expansion of highways, power plants and tourism infrastructure (Figure 54).

Such opposing development expectations are rarely addressed in the current literature where most studies focus on tourism growth as the main goal, with little regard to indirect negative social–cultural and environmental impacts (Gascón & Martinez Mauri, 2017; Orbach, 2004).

Similar to other indigenous settings, bureaucracy contributes significantly to the current underdevelopment in the region (Jacquelin-Andersen, 2018; Marlor, 2010). National government efforts to stimulate development is often stalled by the limited financial support, cumbersome bureaucratic procedures, changes in political stance following every election cycle and the overall lack of support from key government agencies (Figure 54). Improvements often rely on the close collaboration between stakeholders. For example, the creation of dedicated government offices focusing exclusively on Indigenous issues that are sensitive to Indigenous beliefs and worldviews has improved the interaction between the Guna and the national government (Figure 7).

However, there is still lack of reliable funding sources (Section 3.2.1) for the development of Indigenous communities. Most funding from the international community cannot circumvent the national government, leading to the often dysfunctional collaboration between local communities and the national government (Inter-American Development Bank consultant, personal communication, 2 March 2018).

### 4.3 Implications and recommendations

Methodologically, we argue that it is necessary to adopt systems thinking approaches such as the one used in this study in Indigenous contexts similar to Gunayala characterized by many intersecting modernization and development processes where multiple stakeholders are relevant. The benefit of such approaches compared to traditional single-issue-oriented approaches is the ability to capture the ripple effects throughout indigenous SES (Dam Lam et al., 2019). For example, livelihood transition beyond economic impacts, trickles down to food production, and eventually leads to the loss of traditional practices and knowledge sharing (see Section 3.3.1) (see Dam Lam et al., 2023 for more detailed description).

Related to policy-making, the outcomes from such systems thinking and multi-stakeholder approaches can help frame policies that are inclusive and relevant for Indigenous groups. While specific policy formulation should vary between geographical and cultural contexts, we argue that our study has implications for other Indigenous contexts.

First, it shows the importance of adopting trans-generational foresight (see also similar points in Jacquelin-Andersen, 2018; Sotomayor et al., 2019). Current socioeconomic changes and development aspirations differ drastically across age groups in Gunayala (Section 3.2.2). The rapid transition from traditional livelihoods to formal economic activities within a single generation has created an unprecedented ‘generational gap’ within communities, particularly because certain aspects of modernization and development are appealing to the younger population. While traditional governance systems have been trying to bridge the gap at the community level, the national government is still unable to incorporate in policies, plans and programmes that address this ‘old versus new’ dichotomy in development aspirations among Indigenous peoples. Preventing this will most likely require a much better representation of younger people in Indigenous institutions, promotion of workshops that captures trans-generational aspirations, funding education programmes that preserves traditional knowledges (e.g. traditional medicine, conservation of galus) while providing a viable livelihood path for young Gunas to join Gunayala’s traditional institutions, especially in contexts where the rigidity of traditional institutions might create these generational dichotomies. Of course the modalities should depend on the context, but arguably such inclusion could make more visible certain voices in development debates.

Second, our study shows the importance of understanding and acknowledging differentiated value systems (see also Dam Lam et al., 2019; Löfmark & Lidskog, 2017). While indigenous livelihoods have shifted towards more formal economic activities (with all subsequent negative outcomes for some traditional practices, Section 4.1), the core value system of the Gunas has largely been preserved (Sections 3.2.3). While the strong Indigenous institutions and self-determination has undeniably played a crucial role for this (Table 1), we also believe that the actual mechanisms and struggles as outlined in this paper are not always visible to external actors. In this sense it is important for external actors to understand that seemingly desirable goals (e.g. imported food access, capital accumulation, infrastructure development) that are aligned with their worldview, are not necessarily the main aspiration for Indigenous communities. More often than not, they are means to achieve more
important goals such as territorial autonomy, self-determination and cultural preservation. In this sense there is a need for context-sensitive decision-making approaches that minimize the unintended consequences of national-level policies that fail to account for Indigenous groups’ value systems (Section 3.2.2). Again, how this could be achieved would depend greatly on the local context. In our opinion it will most likely require on the one hand participatory multi-stakeholder processes at different levels to ensure that the voices of the different stakeholders are heard and produce safeguard that certain development processes might not proceed if they are at odds with local values and sensibilities. On the other hand, development programmes targeting Indigenous communities should be approach as a State plan through permanent working groups to overcome changing government policy priorities between election cycles and introducing new national government actors unfamiliar with Indigenous peoples’ values and aspirations. This is particularly pertinent in the current context of calls and concerted effort for the self-determination of Indigenous communities in Latin America (Jacquelin-Andersen, 2018; Tockman et al., 2015) and elsewhere (Patankar et al., 2016; Tang & Tang, 2010).

Third, our study shows the pivotal role that strong Indigenous institutions can play in identifying the development aspirations of their communities through exhaustive and iterative consultation processes. The current consultation processes between Guna institutions (Figure 2), beyond achieving the good representation of development aspirations at different spatial levels (i.e. local to regional), they also help achieve a unified voice that is difficult to be exploited by outside interests. However, these multiple levels of consultations and consensus can be at times very inflexible and arguably delay important decisions or create preconditions for ineffective governance, as witnessed by the failures to enforce consistently some resource extraction rules (Section 3.3.2). This might not be visible at first, but it points to the importance of finding a balance between inclusivity and effective governance in Indigenous institutions, which is something that should be considered carefully in this greater push for greater autonomy and self-determination among Indigenous communities in many parts of the world. Arguably improving aspects of bureaucracy, funding and capacity would be crucial as has been pointed in other Indigenous contexts (Jacquelin-Andersen, 2018; Jonas et al., 2012). Oftentimes, community development advances faster than traditional institutions capacity to react and adapt to the changes, leading to unintended consequences across social and environmental aspects. Depending on the context there might be the need for certain deeper changes on how inclusivity, consensus and effective governance are traded-off. These are very tricky waters to navigate as has been shown in this study, without creating preconditions for further cultural erosion and ecological degradation, whether in Gunayala or other Indigenous contexts across the world.

Finally, the findings and broader methodological approach of our study are quite relevant on ongoing discussions about how to localize the Sustainable Development Goals (SDGs) (UN-Habitat, 2016), especially in areas dominated by Indigenous peoples (Dahl et al., 2020; UCLG, 2021). By identifying the development challenges and local realities in Gunayala, we can get strong indications about the development aspirations of the Gunas. Furthermore, our study also shows that although there is certainly a desire to develop Gunayala, the actual path might not reflect the priorities/approach of the national government and should not come at the expense of local culture and SES (Sections 4.1 and 4.2), both of which will have important ramifications for sustainability. This points to the necessity to indeed localize the SDGs in a way that meet the local needs and sensibilities of the Gunas, if Panama is to meet the SDGs. This situation is also likely true in other countries or regions with significant Indigenous populations (e.g. IWGIA, 2020). Although SDG-related aspects were beyond the focus of this study, our mix-method and multi-stage methodological approach shows how it is possible to identify development priorities and related concerns in Indigenous contexts through the voices of Indigenous people. We believe that the overall approach is flexible enough to be deployed and in other Indigenous contexts, and could be instrumental in efforts to localize SDGs in regions dominated by Indigenous peoples. Integrating Indigenous perspectives to generate knowledge and engage in the design and implementation of sustainable development strategies bodes well with calls made through the IPBES (Díaz et al., 2016; Pascual et al., 2017) and the current deliberations around the post-2020 Global Biodiversity Framework.

5 | CONCLUSIONS

The Gunas, like many other Indigenous communities, are at a crossroad where they must decide now the future they want. On the one hand they have perceived the benefits of stronger interactions with the external world (i.e. access to education, new income options, improved healthcare), but on the other hand they have experienced an array of social problems (i.e. loss of cultural identity, noncommunicable diseases, social conflicts). The increased interaction with the outside world over the last 20 years has triggered rapid socioeconomic and environmental changes in Gunayala. New values have emerged that emphasize capital accumulation and consumerism, and are often at odds with traditional worldviews, beliefs and traditions. However, there have been undoubtedly improvements across the region due to infrastructure development, access to education, livelihood diversification and better healthcare, which have empowered the younger generation. Such improvements are welcome by the Gunas but expanding these achievements without losing their cultural identity remains a priority for them.

In this changing context, the local chiefs are struggling to balance a development agenda and maintain the SES, but there is a perceived leadership decline in local and regional institutions as being protectors of Guna identity. The local chiefs are expected to lead community projects that strengthen social cohesion and preserve important traditional ceremonies, while regional chiefs are expected to steer Gunayala’s development during this transition period and preserve their worldview and beliefs. However, there is an emerging perception that the traditional institutions currently lack the
capacity to respond to these challenges proactively and in a timely manner. The absence of stable funding independent to the national government, and the shortage of trained Gunas able to secure and implement programmes sponsored by international agencies are among the challenges that the current governance structure has to overcome.

Currently there is no clear blueprint to accomplish the development aspirations of the Gunas and at the same time preserve cultural identity and the broader SES. Nevertheless, identifying and acknowledging the perspective of the Gunas, opening inclusive channels of communications between key development actors, and understanding Guna values, concerns, and what they perceive as trade-offs, can help foster a development path that is in accordance with their needs, balancing development and the preservation of their identity.

AUTHOR CONTRIBUTIONS
Rodolfo Dam Lam and Alexandros Gasparatos conceived the ideas and designed methodology; Rodolfo Dam Lam collected and analysed the data; Rodolfo Dam Lam wrote the first draft and Alexandros Gasparatos edited the manuscript. All authors contributed critically to the manuscript and gave final approval for publication.

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CONFLICT OF INTEREST STATEMENT
Alexandros Gasparatos is an Associate Editor for People and Nature, but was not involved with the peer review and decision-making process.

DATA AVAILABILITY STATEMENT
The data used on this study consist primarily of expert interviews following the free, prior and informed consent rights for Indigenous peoples. Providing the full transcript from the interviews will compromise the confidentiality of respondent and violate the agreements given to the Guna authorities.

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ENDNOTES
1 Traditional roles in Gunayala includes ritual specialist, traditional healers, spiritual leaders with skill and knowledge to conduct therapeutic chants and use of medicinal plants (Apgar et al., 2015).
2 The Gunas defines culture as the blend of their values, institutions, history, language, practices, traditions and spirituality that conform their Guna identity and are embodied through their beliefs, art, socio-political structure developed throughout the centuries (Congreso General Guna, 2013).
3 Social-ecological systems are integrated system of humans and environment. They are complex adaptive systems in which social and ecological subsystem are interdependent of each other through a series of feedback relationships. These systems may include linkages through knowledge systems such as Indigenous knowledges or scientific knowledge (Berkes, 2017).
4 This paper is part of a bigger study that explores different aspects of social-ecological system change and sustainability in Gunayala. The present study focuses on identifying the major development challenges in Gunayala. A follow-up study unpacks how one development challenge, namely dietary change, intersects with social-ecological system change (see more information at Dam et al., 2023).
5 This document must be presented at Gunayala borders controls. Failure to provide it can result in decline to enter Gunayala or eviction if found to conduct research without it in Gunayala.
6 The community (usually an island) is the main social unit for the Gunas (Davis, 2014).
7 Service-related projects (e.g. healthcare, agricultural production and sanitation) at community level are considered to be minor projects. Thus Local Congresses can conduct community-level consultation processes without the need for approval from the Guna General Congress (Administrative Congress ex-General secretary, personal communication, 12 March 2018).
8 The interested reader is diverted elsewhere for a more detailed explanation of how diet change intersects with these social impacts (Dam et al., 2023).
9 Localizing the SDGs refers to the process of “taking into account subnational contexts in the achievement of the 2030 Agenda, from the setting of goals and targets, to determining the means of implementation and using indicators to measure and monitor progress. Localization relates both to how the SDGs can provide a framework for local development policy and to how local and regional governments can support the achievement of the SDGs through action from the bottom up and to how the SDGs can provide a framework for local development policy” (UN-Habitat, UNDP, UCLG, 2016: p. 6).

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**SUPPORTING INFORMATION**

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

Table S1: Characteristics of expert interviews.
Table S2: Sampling groups and size for community surveys.
Figure S1: Sampling frame for the community survey in Soledad Miria, Gunayala. Source (Google Maps, 2019).
Figure S2: Main challenges in Gunayala due to current development, their trend, and consensus level among interviewees.
Figure S3: Main environmental challenges in Gunayala due to current development, their trend, and consensus level among interviewees.
Figure S4: Main governance challenges in Gunayala affecting their development, their trend, and consensus level among interviewees.
Figure S5: Main social challenges in Gunayala due to current development, their trend, and consensus level among interviewees.
Table S3: Cultural practices variables used for the household survey.
Table S4: Main livelihood activities for entire sample by island.
Table S5: Perceived values associated with components of Gunayala’s social-ecological system.
Table S6: Detailed ecosystem services provided by each social-ecological system components.
Figure S6: Summary dashboard of key resources in Gunayala.
Figure S7: Saturation point of challenges coding from expert interviews.

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