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Introducing a common taxonomy to support learning from failure in conservation

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Abstract

Although some sectors have made significant progress in learning from failure, there is currently limited consensus on how a similar transition could best be achieved in conservation and what is required to facilitate this. One of the key enabling conditions for other sectors is a widely accepted and standardized classification system for identifying and analyzing root causes of failure. We devised a comprehensive taxonomy of root causes of failure affecting conservation projects. To develop this, we solicited examples of real-life conservation efforts that were deemed to have failed in some way, identified their underlying root causes of failure, and used these to develop a generic, 3-tier taxonomy of the ways in which projects fail, at the top of which are 6 overarching cause categories that are further divided into midlevel cause categories and specific root causes. We tested the taxonomy by asking conservation practitioners to use it to classify the causes of failure for conservation efforts they had been involved in. No significant gaps or redundancies were identified during this testing phase. We then analyzed the frequency that particular root causes were encountered by projects within this test sample, which suggested that some root causes were more likely to be encountered than others and that a small number of root causes were more likely to be encountered by projects implementing particular types of conservation action. Our taxonomy could be used to improve identification, analysis, and subsequent learning from failed conservation efforts, address some of the barriers that currently limit the ability of conservation practitioners to learn from failure, and contribute to establishing an effective culture of learning from failure within conservation.

KEYWORDS
adaptive management, classification, failure, informing solutions, learning, reflection

Introducción de una taxonomía común como apoyo al aprendizaje a partir del fracaso en la conservación

Resumen: Mientras que algunos sectores han progresado significativamente en el aprendizaje a partir del fracaso, actualmente hay un consenso limitado sobre cómo podría lograrse una transición similar en la conservación y qué se requiere para facilitarla. Una de las condiciones habilitantes más importantes en otros sectores es un sistema de clasificación estandarizado y aceptado por la mayoría para la identificación y análisis de las causas fundamentales del fracaso. Diseñamos una taxonomía completa de las causas fundamentales del fracaso que afecta a los proyectos de conservación. Para desarrollarla, solicitamos ejemplos de esfuerzos de conservación reales que de alguna manera se consideraron como fracasos, identificamos las causas fundamentales no aparentes de su fracaso y luego las usamos para desarrollar una taxonomía genérica de tres niveles de las maneras en las que fracasan los proyectos, en cuyo nivel superior están seis categorías de causas generales que después se dividen en categorías de nivel medio de categorías de causas y causas fundamentales específicas. Pusimos a prueba la taxonomía al pedirle a los practicantes de la conservación que la usaran para clasificar las causas del fracaso de los esfuerzos de conservación en los que han participado. No identificamos vacíos o redundancias importantes durante esta fase de prueba. Después, analizamos la frecuencia con la que los proyectos de esta muestra se enfrentaron a causas fundamentales particulares, lo que sugirió que algunas causas fundamentales tienen mayor probabilidad de ocurrir y que un número reducido de causas fundamentales tiene mayor probabilidad de ocurrir en proyectos que implementan ciertos tipos de acciones de conservación. Nuestra taxonomía podría usarse para mejorar el análisis, identificación y aprendizaje subsecuente a partir del fracaso de los esfuerzos de conservación; tratar algunas de las barreras que en la actualidad limitan a los practicantes de la conservación a aprender del fracaso; y contribuir al establecimiento de una cultura efectiva del aprendizaje a partir del fracaso dentro de la conservación.

PALABRAS CLAVE
aprendizaje, clasificación, fracaso, informar soluciones, manejo adaptativo, reflexión

【摘要】
虽然一些部门能够很好地从失败中吸取教训, 但目前对于如何在保护中最好地实现类似的转变及其必需条件的共识仍十分有限。其他部门的关键赋能条件之一是有一个广泛被接受和标准化的分类系统来识别和分析失败的根本原因。本研究设计了一个影响保护项目失败的根本原因的综合分类法。为了建立这一套分类法, 我们收集了现实世界中被认为在某些方面失败了的保护工作的案例, 确定了其失败的根本原因, 并利用这些案例制定了一个通用的项目失败方式三层分类法, 其顶端是六个总体原因类别, 并进一步分为中层原因类别和具体根源。我们要求保护实践者使用该分类法对他们所参与的保护工作的失败原因进行分类, 以对该分类法进行测试。在测试阶段没有发现明显的空缺或冗余。接下来, 我们分析了测试样本项目遇到特定失败根源的频率, 结果表明一些根源更为常见, 少数根源更有可能在实施特定类型保护行动的项目中出现。我们的分类法可用于改进对失败保护工作的识别、分析及随后的教训学习, 解决目前限制保护实践者从

失败中学习的能力的一些障碍, 并有助于在保护中建立有效的从失败中学习的文化。【**翻译: 胡怡思; 审校: 聂永刚**】

关键词: 失败, 分类, 学习, 适应性管理, 反思, 提供解决方案

INTRODUCTION

Need for a culture shift

Despite some notable conservation successes (Sodhi et al., 2011; Temple, 1986; Zerbini et al., 2019), most recent analyses show that global biodiversity continues to decline at an alarming rate (Diaz et al., 2019). In light of this, conservation practitioners are increasingly looking toward the lessons that can be gained through failure as a means of improving conservation practice and increasing its impact.

All initiatives carried out within complex environments should expect to experience failure (Catalano et al., 2018, Hickey et al., 2015). However, the way failure is dealt with can make an enormous difference to subsequent practice. There is now widespread recognition across multiple sectors that objective, robust analyses of the causes of failure and the contexts in which failure occurs have the potential to drive significant improvements in learning and subsequent practice (Edmonson, 2011; Harford, 2011).

Although it is possible to find examples of failure in conservation (Turvey, 2008; Varnham et al., 2002), these are rarely well documented with in-depth examination of how and why failure occurred and how it could be avoided in future. Catalano et al. (2019) recently reviewed the literature for cases of failure in conservation. Although they found several examples of published conservation failures, there were relatively few overall and most lacked standardization. Of the cases identified, 71% of lead authors were affiliated with an academic institution, and 8% and 7% were affiliated with nongovernmental organizations (NGOs) and government agencies, respectively. Given that nonacademic institutions (primarily government agencies and NGOs) carry out a large proportion of conservation work, it is likely a safe assumption that many project failures are not systematically documented and shared outside of the implementing team or organization and sometimes not at all. Catalano et al. (2019) suggest this constitutes a vast missed learning opportunity for the conservation sector. This lack of a culture of recording and sharing failure, where the primary aim is to maximize learning rather than apportion blame, stands in sharp contrast to several other sectors that can demonstrate significant progress resulting from the adoption of a culture of systematically recording, discussing, and learning from failure (Catalano et al., 2018; Schulz, 2010; Syed, 2016).

Nothing less than a culture shift is needed. Although it is true that conservation often takes place in highly complex, dynamic, and changing environments, where practitioners often lack time and resources, conservation professionals should not fall into the trap of viewing conservation failures as inevitable, purely the result of human error, and not worthy of detailed scrutiny (Catalano et al., 2018).

Although the importance and value of learning from failure is widely acknowledged, less attention has been paid to the enabling conditions required to facilitate this. We aimed to contribute to establishing such enabling conditions by proposing a taxonomy of root causes of failure in conservation, demonstrating its application to a subset of real-life conservation interventions that failed in some way, and identifying further opportunities for applying the taxonomy to help improve practice and remove barriers to learning from failure in conservation.

Need for a taxonomy of root causes of failure

Learning from experience can be facilitated by the adoption of a common language (i.e., a taxonomy or classification scheme) so that information can be easily recorded, understood, and analyzed without the need for a detailed explanation of specific contexts and conditions. Taxonomies developed for conservation threats, stresses, and actions (Salafsky et al., 2008) have been widely applied by practitioners to plan, document, and categorize their work (Diaz et al., 2019; Sutherland et al., 2019). A taxonomy of reasons for failure could help conservationists record, frame, analyze, and synthesize information resulting from failure in a similar way.

Other sectors have introduced standardized systems for recording and analyzing failure. For example, the International Civil Aviation Organization (ICAO) maintains a database of all aviation crashes, categorizing failures according to a set typology (ICAO, 2020). Similarly, a database of car crash reports (taken from police reports) has long been used by car manufacturers to improve vehicle safety standards and has been cited as one of the factors in the dramatic reduction in car crash fatalities over the last half century (Syed, 2016).

Of all the aspects of failure that a taxonomy could focus on, categorizing the root (ultimate and underlying) causes of failure has the potential to be particularly useful because it would allow the conservation community to mirror widespread practice in other sectors where learning from failure typically starts with the identification of the underlying reasons causing failure (Schulz, 2010). There are many reasons why those working in conservation do not record and publish failure, ranging from human psychology to external constraints and influences (Catalano et al., 2018; Lamoreux et al., 2014; Redford & Taber, 2000). Although the creation of a taxonomy of root causes will not be sufficient to establish fully a culture of learning from failure, we consider it one of the key enabling conditions required to facilitate this change.

METHODS

Taxonomy development

The development of the taxonomy was led by a core team of collaborating organizations with further input from several others. We developed the taxonomy based on examples from participating organizations of real-life conservation interventions considered to have failed in some way. Collaboration was key to the development of the taxonomy. Within and across the participating organizations, there was a broad spectrum of different project types, activities, and disciplines. We were therefore able to draw on a broader range of project types and practitioner experience than would have been possible had a single organization—or type of organization—developed a taxonomy in isolation. Previous researchers highlight collaboration as one of the key components needed to overcome barriers to learning from failure in conservation (Meek et al., 2015; Sanders et al., 2019).

During the initial planning phase, we identified 4 primary concerns that influenced the protocol for gathering examples from participating organizations. The first was that definitions of failure are often highly subjective; separate individuals often have quite different perceptions of what constitutes failure (Edmondson, 2012). We also recognized that in many cases, failure and success will not be binary outcomes; instead, they will be graded along a continuum of partial failure and partial success. Therefore, our concern was that conversations around failure would become overly focused on whether or not something constituted a failure, with less time spent on understanding how or why it occurred and any subsequent learning. The second concern was that information collected would be biased toward certain types of failure (e.g., heroic failure [i.e., an intervention perceived to fail initially but is ultimately spun as a success due to the efforts of the project team]). The third focused on the ethical implications of gathering information on failure, where information provided could be used to identify specific projects, individuals, or organizations with potentially negative consequences for those providing examples. The fourth concern was that the method of collecting information was likely to have a considerable effect on the quantity and quality of responses. Published accounts of failure in conservation are rare (Catalano et al., 2019), and in those that exist analysis of how and why failure occurred and how it could have been avoided is limited. Therefore, we sought to develop a simple, informal protocol that avoided requiring practitioners to spend time providing examples in a systematic format similar to that required for scientific peer review.

To develop the taxonomy, each participating organization nominated an institutional contact who, from April through May 2019, identified colleagues involved in conservation projects that these colleagues believed had failed in some way. When gathering examples, we defined failure simply as a lack of success at delivering stated objectives or outcomes. Institutional contacts then asked those colleagues to identify the root causes of failure in each case. Root causes were defined as ultimate causes of failure (how the failure arose), as opposed to proximate causes (causes that subsequently arose as a result of an ultimate cause). However, in each case we allowed respondents to define the root causes of failure themselves. We acknowledge that a root cause of failure identified by 1 respondent may be considered a proximate cause of failure by another.

These root causes were then cleared of any case-specific identifiers and entered into an anonymous online form by the institutional contacts. The form was used to collate all root causes as a single list without revealing where the example originated. In June 2019, we convened a workshop in which 21 participants from 14 conservation organizations and 3 academic institutions used the list of examples to develop a 3-tier taxonomy of root causes of failure (tier 1, overarching cause category; tier 2, midlevel cause category; tier 3, specific root cause). This involved grouping submitted root causes under broad categories and then refining the language further to reflect generic root causes, rather than context-specific examples. After the workshop, the taxonomy went through several rounds of review and revision to refine the language and to insert or delete causes that were thought to be missing or superfluous.

This protocol addressed our first concern by applying a broad definition of failure, which allowed discussion to move quickly onto reasons and root causes, minimizing the risk of becoming overly focused on whether an example constituted a failure. The protocol addressed our second and third concerns by ensuring the anonymity of those providing examples and of the examples themselves so that at no point would it be possible for anyone outside the organization providing the example to identify specific projects, individuals, or organizations. The protocol addressed our fourth concern by ensuring that the main means of data collection was informal and led by someone from within their organization. This reflected our view that information on failure is primarily shared informally within project teams and organizations, rather than written up in a standardized way for external communication (e.g., as a case study or structured questionnaire). University of Cambridge Humanities and Social Sciences Research Ethics Committee approved the protocol in March 2019.

Testing and application

Once developed, we tested the taxonomy by asking conservation practitioners, both those who provided examples during the initial taxonomy development and others who did not, to complete an anonymous, online questionnaire to classify examples of failed projects they had been involved in, select the root causes that applied, and highlight any gaps or inconsistencies in the taxonomy. The resulting feedback was used to further refine the root-cause wording and categorization. Practitioners were also asked to highlight the type of conservation action implemented by the project (land or water management; species management; awareness raising; law enforcement; livelihood economic and moral incentives; developing or implementing legal and policy frameworks; planning and designation; research and monitoring; education and training; and institutional development [Salafsky et al., 2008]). Participants could select more than 1 option to account for projects implementing multiple action types. For this test phase, we solicited responses from those who provided the initial examples used to develop the taxonomy and contacted individuals in other conservation organizations, funders, and practitioner networks. The test phase ran from August 2019 to September 2020; all responses submitted during that time were included in the analyses.

Analysis of patterns and trends in reporting of root causes within the test sample

Using the data collected from the testing phase, we calculated the number of root causes of failures reported by for project and the percent occurrence of different root causes for both the highest and lowest tier of the taxonomy (tiers 1 [overarching cause] and 3 [specific root cause]).

In addition, we undertook a further, exploratory analysis to identify the most frequently reported tier 3 root causes overall and, where the sample size allowed, to identify projects implementing specific conservation action types (Salafsky et al., 2008). Our aim was to demonstrate how such an analysis could inform subsequent identification of potential solutions. To do this, we ran chi-squared goodness-of-fit tests for the entire response data set and for each conservation action type. We applied the commonly used threshold of 2 standardized residuals (Agresti, 2003) to provide an indication of whether a particular root cause was more frequently encountered than other root causes. For example, in projects with a species management component a standardized residual value of >2 indicated that a particular root cause was more frequently encountered by those projects than other root causes.

We also carried out a chi-squared test of independence with the entire response data set to identify whether any frequently reported root causes were particularly associated with projects implementing specific action types. For example, whether a particular root cause was more likely to be encountered by projects with a species management component than those implementing other types of conservation action. We again applied a threshold of 2 standardized residuals to provide an indication of whether a particular root cause was associated with a specific action type.

RESULTS

Taxonomy development

Fourteen participating organizations submitted 286 root causes. We organized these into a taxonomy (Table 1) in which root causes were grouped into a 3-tier hierarchy, at the top of which are 6 overarching cause categories that are further divided into midlevel cause categories and specific root causes.

Although not our explicit intention, the resulting categories had many parallels with existing decision-support frameworks. Although a comprehensive analysis of the overlap with our taxonomy and these frameworks is beyond the scope of this paper, it is notable, for example, that planning, design, or knowledge (overarching category 1) had many parallels with steps 1–4 in systematic conservation planning (Margules & Pressey, 2000) and with steps 1–5 in structured decision-making (Gregory et al., 2012).

These parallels were particularly noticeable when comparing the taxonomy to the plan, implement, learn, and adapt steps that underpin many project cycle and adaptive management frameworks. For example, in comparing the taxonomy to the 5-step cycle utilized by the Conservation Standards (CS) (CMP, 2020), one of the most widely applied adaptive management frameworks in conservation, category 1, planning, design, or knowledge, has many overlaps with CS assess and plan steps. Categories 2 (implementation), 3 (internal governance structures), and 4 (resources) are all highly relevant to CS implement step. Categories 5 (stakeholder relationships) and 6 (unexpected external events) largely relate to factors often monitored and assessed during CS analyze and adapt steps.

Taxonomy testing and application

The test phase captured information from 122 projects through which 905 total root causes were identified. All 59 root causes in the taxonomy were reported at least once during the testing phase. The number of root causes reported by an individual project ranged from 1 to 26, with most projects reporting 2–6 root causes (Figure 1). No significant gaps or redundancies were highlighted during the testing phase. The final wording of overarching categories 2 and 5 (Table 1) was modified slightly based on participant feedback (from implementation and relationships with external stakeholders categories, respectively). A number of additions and edits were also made to the descriptions and examples accompanying root causes to provide further guidance and clarity, particularly where a participant found it difficult to classify a specific example. A number of participants highlighted the potential value of further interrogating how and why failure occurred, particularly when root causes related to relationships between those involved in the project (see "DISCUSSION").

Root causes due to planning, design, or knowledge were reported by the highest number of projects in the test sample (82% of projects), followed by root causes due to stakeholder relationships (60%), resources (50%), team dynamics (48%), and governance structures (30%). Those relating to unexpected external events were the least reported (15%). Information on the reporting frequency of all tier 3 root causes is in Appendix S1.

Our first set of tests provided a strong indication that some root causes were more frequently encountered than others ($n = 905$, $\chi^2 = 385.5$, df $= 58$, $p \geq 0.001$). Table 2 highlights the most frequently encountered tier 3 root causes both overall and specifically for projects that included a species management component. All individual action type test results and standardized residual values are in Appendix S1.

Our second set of tests did not provide a strong indication that root causes in general were more likely to be associated

TABLE 1 Taxonomy of root causes of failure affecting conservation projects

Root cause of failure	Description	Examples
1. Planning, design or knowledge	Failures relate to the way projects are conceived and conceptualized, taking into account knowledge inputs, design, and planning	
1.1. Knowledge inputs to project design		
1.1.1. Ecological knowledge	Lacking sufficient information on the ecology of the conservation target for project design to be effective	Unsuitable species reintroduction location chosen due to lack of information on species habitat requirements
1.1.2. Social and socioeconomic knowledge	Lacking sufficient knowledge of the social, cultural, or economic conditions surrounding or relating to the conservation target	Promoted alternative livelihood practices were unsuitable for the communities targeted due to a lack of information on local access to markets
1.1.3. Other contextual knowledge	Lacking sufficient knowledge of local contexts and conditions (other than ecological or socio economic) that could affect the project	Insufficient knowledge of the legal permits and certifications needed to work in the target area and how to obtain these
1.1.4. Evidence of approach	Lacking sufficient evidence on the effectiveness of the proposed solution to the conservation problem that the project is trying to address	Approach had not been tested beforehand and proved inappropriate for the project's target species
1.2. Project design		
1.2.1. Definition of conservation problem	Project design not based on the identification of a clearly defined conservation problem	Activities to protect an important wetland did not consider the necessary characteristics of wetland health to target or the main threats needed to be addressed (or whether these needed to be addressed)
1.2.2. Theory of how change would be achieved (including assumptions)	Mechanism for addressing the problem proved insufficient, inadequate, or both for bringing about the desired change (i.e., the project's theory of change did not work in practice)	Financial incentive schemes failed to deliver the intended changes in behavior
1.2.3. Monitoring, evaluation, & learning	Systems for capturing information on progress, effectiveness, and impact did not allow for effective information capture and learning	Monitoring systems failed to identify that the approach was not working until it was too late to change or adapt
1.2.4. Budget design	Not allocating enough funding during the design phase to achieve the desired outcome	Original budget was only sufficient to cover half the proposed activities
1.2.5. Setting of clear or realistic goals or objectives, etc.	Setting goals or objectives beyond what could be realistically delivered with the time or resources available or lacking sufficient clarity to inform effective planning and subsequent implementation	One-year project aimed to achieve a change in legal protection for a target site when the typical time for achieving legal protection in the target country was 2–3 years and without specifying the level of legal protection that would be necessary
1.2.6. Technology or methodology used	Using inappropriate or inefficient methods, techniques, or materials	Pumping equipment for managing water levels failed shortly after first use, meaning habitat management plan could not be implemented
1.3. Sustainability planning or exit strategy		
1.3.1. Planning for inevitable staff turnover	Not planning for likely changes in personnel	Knowledge or expertise of departing staff not captured or passed onto newly recruited staff
1.3.2. Exit or sustainability strategy	Lacking a clear plan for disengaging from or ensuring sustainability of the project	No clear plan for ensuring long-term sustainability of the tools developed & produced by the project
1.4. Consultation during design phase		
1.4.1. Stakeholder engagement during planning	Insufficient engagement or input during design phase from relevant stakeholder groups	Awareness raising workshops designed in the wrong language

(Continues)

TABLE 1 (Continued)

Root cause of failure	Description	Examples
2. Team dynamics	Failures primarily relating to relationships and dynamics within project teams (see category 3, internal governance structures, for failures relating to the way projects are structured and category 5, stakeholder relationships, for failures due to relationships with and between those involved or affected by the project but who are not part of the core, implementing team)	
2.1 Project management or supervision		
2.1.1. Leadership or supervision of project staff by project manager(s)	Project management not providing effective support, supervision, or guidance	Lack of engagement or communication from project manager resulted in a lack of motivation among the rest of the team to deliver project
2.1.2. Delegation	Inadequate delegation of roles & responsibilities within the team	Project leader did not provide staff with enough autonomy to do their duties within the time needed
2.1.3. Adaptive management	Lacking necessary adaptation of approach, roles, etc., when required or ability to detect when this was needed	Project leadership did not change approach when monitoring data suggested that the current approach was not working
2.1.4. Support from senior staff outside the project team	Lacking necessary support or buy-in from senior management to the project team	Senior management did not believe the project was a priority, resulting in resources being directed elsewhere
2.1.5. Budget management	Ineffective management of funds allocated to the project	Disproportionate amount of budget spent on nonessential costs, leaving insufficient funding to meet objectives
2.1.6. Coordination	Ineffective planning, consultation, and feedback between management and others involved in implementation	Information on timelines was not communicated by management to the rest of the team, resulting in key deadlines being missed
2.1.7. Management at a distance	Management too far removed from day-to-day running of the project to provide necessary support, direction, or oversight	Project manager located in a regional office far from project site and was not able to respond to changing local conditions effectively
2.2. Project delivery (by project staff)		
2.2.1. Motivation among project staff	Staff lacking motivation to implement project activities effectively	Primary interest of project staff was in ecological research and had limited interest in implementing other components of the project
2.2.2. Communication between project staff	Poor communication between those involved in implementation	Some key activities missed due to staff assuming that they were being covered by others
2.2.3. Shared vision or values among project team	Lack of understanding or change in understanding by those involved in the project as to what the project should be doing, what the priorities are, or how these should be resourced	Differences in opinion between science and field staff on which activities should take priority
2.2.4. Corruption by implementing project staff	Corruption by staff directly involved in implementation or employed by the implementing organization	Project staff participating in illegal practices that the project was trying to prevent
3. Internal governance structures	Failures relate to the way projects are structured, particularly their levels of governance and systems or procedures for communicating information between governance levels (for failures relating to relationships between those involved in the project see category 2, team dynamics, and category 5, stakeholder relationships	
3.1. Project governance structures		

(Continues)

TABLE 1 (Continued)

Root cause of failure	Description	Examples
3.1.1. Management or governance structures lacking key elements	Elements of project management or governance structure either missing or not functioning effectively	Project did not set up technical advisory group to oversee running of the project
3.1.2. Clarity of roles or responsibilities (governance)	Roles & responsibilities of those involved in the project not clearly defined	Unclear who was responsible for collecting input from project stakeholders to feed into project monitoring, evaluation, and learning plan
3.1.3. Clarity of legal structures	Legal structures set up to facilitate functioning of the project not clearly defined	Contractual limitations on transferring funds between partner organizations were poorly understood resulting in funding delays and missed milestones
3.1.4 Communication between governance levels	Lacking effective communication between levels of project governance	Important information not passed from project team to steering committee
3.2. Systems & structures for identifying risk or mismanagement		
3.2.1. Systems for identifying and dealing with risk or mismanagement (e.g., corruption)	Project lacked the proper structures and procedures necessary to identify and deal with risk and mismanagement	Project decided not to carry out an audit, which meant that key risks and issues were not identified in time
3.3. Systems & structures for learning		
3.3.1. systems & structures for learning	Governance structure not allowing for necessary learning and adaptation	Project governance did not include an effective process for capturing lessons and determining when to act on these, leading to key problems not being addressed
4. Resources	Failures relate primarily to the existence and availability of resources (see category 2, team dynamics, for mismanagement of resources)	
4.1. Funding		
4.1.1. Funding delays	Delays in receiving funding from donors or funders	Delay in signing grant agreement meant that key activities could not be carried out in time
4.1.2. Funding reallocation	Funding reallocated to cover other areas of work within organization	Funding reallocated to cover gaps in another department's budget
4.1.3. Ability to secure necessary cofunding	Project did not receive or raise cofunding needed for implementation	Project unable to raise sufficient funds to match initial seed funding
4.1.4. Funding levels	Funding received was insufficient to complete project	Higher than expected staffing costs meant that some key activities could not be completed
4.1.5. Ability to ensure sustainability of funding or resources	Unable to ensure continuity of funding or resources to support work beyond initial investment	Funding not secured beyond length of initial 3-year grant period
4.2. Human capacity and expertise		
4.2.1. Staffing levels	Insufficient staff numbers to carry out effective implementation	Unable to recruit a suitable project manager, field staff, etc.
4.2.2. Staff workload	Staff involved in implementation unable to work effectively due to overly high workload	Overcommitted or overstretched staff leading to key targets being missed
4.2.3. Administrative burden	Burden of administration (e.g., reporting, financial management, recruitment, etc.) negatively affects implementation	Fulfilling reporting requirements took up a disproportionate amount of project staff time that affected delivery of other activities
4.2.4. Technical expertise	Lack of necessary knowledge, skills, experience, etc.	Skills and capabilities of those involved in implementation did not matching the skills or capabilities required for effective delivery
4.2.5. Ability to maintain sufficient expertise	Loss of essential knowledge skills, or experience and inability to effectively replace this	Unable to replace departing staff with others with the required level of skills or experience

(Continues)

TABLE 1 (Continued)

Root cause of failure	Description	Examples
4.3. Physical resources		
4.3.1. Sufficient physical resources	Lack of the physical resources needed to implement the project	Project lacked necessary equipment, transportation, and office space required
4.3.2. Maintenance of physical resources	Resources or materials used in the project not maintained to the level required	Project vehicle broke down due to lack of maintenance meaning that staff could not visit project sites
5. Stakeholder relationships	Failures relate to relationships with and between key stakeholders involved in the project but not part of the core implementing team (e.g., local authorities, communities, collaborating organizations) (see category 2, team dynamics, for failures relating to relationships within project teams)	
5.1. Funder support		
5.1.1. Funder support	Loss of, change in, or disconnects in support, engagement, or both by project funder	Funder not satisfied with progress in the first phase of the project so decided not to provide additional funding to support the second phase
5.2. Support from key stakeholders		
5.2.1. Support from or access to key government bodies and decision makers	Lack of support or buy-in from existing relevant government agencies or individuals	Government officials unwilling to support a change in the law proposed by the project
5.2.2. Change in key government bodies or decision makers	Loss of or inability to ensure continuity of existing support resulting from a change in relevant government agencies or individuals	Election in the middle of the project meant the team had to try to establish new relationships with elected officials, who were not as supportive as the previous administration
5.2.3. Community support	Not enough support from local communities in and around project	Project team was unable to secure permission from local communities to target sites
5.2.4. Unintended impacts on community	Unintended impacts resulting from the project negatively affected delivery	Project's actions to improve local livelihoods had the unintended impact of attracting more people to live in the area who had no understanding of the conservation context and restarted or carried on the damaging practices the project was trying to stop
5.2.5. Engagement of landholders	Lack of support from stakeholders owning or controlling land relevant to the project or loss of or inability to ensure continuity of existing support from stakeholders owning or controlling land relevant to the project	Local landowners unwilling to adopt land management practices promoted by the project
5.2.6. Ability to build or catalyze support from general public	Inability to build support from general public in relation to the project's conservation goals	Project unable to communicate a compelling, easily understood narrative to gain public support
5.2.7. Engagement with relevant allied stakeholder organizations	Dysfunctional or nonexistent relationships with stakeholder organizations supportive of the project's aims or working to achieve similar outcomes	Poor engagement and communication with allied organizations resulted in a lack of a strong unified voice in policy negotiations
5.2.8. Engagement with relevant opposed stakeholder organizations	Dysfunctional or nonexistent relationships with stakeholder organizations not supportive of the project's aims or working to achieve opposing outcomes	Project unable to convince agricultural conglomerate to participate in the development and adoption of sustainable practices for their operations
5.3. Stakeholder agendas		
5.3.1. Conflicting agendas among project stakeholders	Key stakeholder agendas not aligned or in opposition to each other	Stakeholders all tried to shape the project according to their specific needs and interests
5.4. Corruption and illegal activities		
5.4.1. Corruption (external to project staff)	Corruption carried out by individuals not directly working on the project	Planning officials accepted bribes from property developers to approve construction within protected area

(Continues)

TABLE 1 (Continued)

Root cause of failure	Description	Examples
5.4.2. Illegal activity (external to project staff)	Illegal activity carried out by individuals not directly working on the project	Illegal persecution from hunters prevented efforts to establish a successful breeding population at the target site
6. Unexpected external events	Failures relate to external events that cannot be predicted or influenced by the project	
6.1. Environmental events		
6.1.1. Climate or weather	Climatic conditions and weather events	Floods, droughts, hurricanes, tornadoes
6.1.2. Other natural disasters	Natural disasters other than those caused by weather or climate	Earthquakes, volcanic eruptions, tsunamis
6.1.3. Wildlife disease	Diseases affecting wildlife, either directly affecting species targeted by the project or other nontargeted species that affected the project in some way	Botulism outbreak affecting waterbird populations, respiratory disease in ungulate populations
6.2 Human events		
6.2.1. Conflict or insecurity	Conflict or insecurity in a project area	Civil unrest restricted access to project sites
6.2.2. Human, domesticated animal, or domesticated plant disease	Cases or outbreaks of disease primarily affecting humans, domesticated animals, or domesticated plants	Covid-19 pandemic restricted access to project sites

Note: Each of the 6 overarching categories (e.g., 1. planning, design, or knowledge) is divided into a number of midlevel categories (e.g., 1.1 knowledge inputs to project design). The midlevel categories are further divided into specific root causes (e.g., 1.1.1. ecological knowledge) each of which is accompanied by a description and an example. The number of decimal places denotes the taxonomy rank.

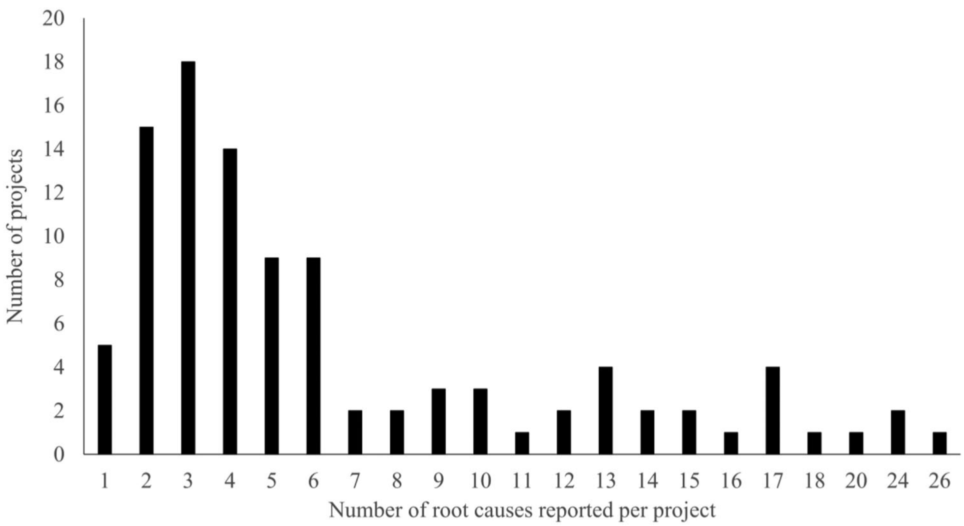

FIGURE 1 Distribution of number of root causes reported per project

with particular conservation action types ($n = 905, \chi^2 = 493.15$, df = 522, $p = 0.813$). However, analysis of the resulting standardized residual values highlighted a small number of root causes that may show a close association with particular action types. For example, results indicated that failure due to insufficient or inadequate ecological knowledge (1.1.1 in Table 1) and from lacking sufficient evidence on the effectiveness of the proposed solution (1.1.4 in Table 1) were both more likely to be encountered by projects that included a species management component than those that did not.

DISCUSSION

Taxonomy completeness and applicability

All root causes in the taxonomy were reported at least once during the testing phase, suggesting a lack of redundant or superfluous causes or categories. From the test group, <5% of projects reported a single root cause of failure (Figure 1). This suggests that a failed conservation effort often has multiple root causes, which may be interrelated. This has much in

TABLE 2 Frequently encountered root causes of conservation failure across all considered projects and by projects implementing species management actions[a]

Data source (number of projects)	Cause of failure[b]
All projects (122)	1.2.2. Theory of change 5.2.1. Government support 4.2.4. Technical expertise 1.1.1. Ecological knowledge 1.1.4. Evidence of approach 1.4.1. Stakeholder engagement during planning 5.3.1. Conflicting agendas 2.1.3. Adaptive management 2.2.3. Shared vision or values among project team 3.1.1. Management or governance structures lacking key elements 2.1.1. Leadership or supervision of project staff by project managers 2.1.6. Coordination 4.2.2. Staff workload 5.2.3. Community support
Projects with a species management component (51)	1.1.1. Ecological knowledge[c] 1.2.2. Theory of change 1.1.4. Evidence of approach[c] 4.2.4. Technical expertise 2.1.3. Adaptive management 4.2.2. Staff workload 5.2.1. Government support

[a]Causes listed in descending order of frequency. Indication of frequency based on standardized chi-square residual values of >2.
[b]Numbers are used to demarcate categories in Table 1.
[c]Root causes more closely associated with projects implementing species management actions than those implementing only other types of action. Indication of association based on based on standardized chi-square residual values of >2.

common with the IUCN Conservation Measure Partnership (CMP) threats and conservation actions classifications (Salafsky et al., 2008), where multiple interrelated threats may affect a target and require multiple interrelated actions to address.

All those who responded during the testing phase reported that the taxonomy was simple and easy to use. Some participants highlighted root causes they found difficult to classify. In the majority of cases, these resulted in revisions being made to the descriptions and examples accompanying existing root causes. The main exceptions to this relate to a subset of reasons relating to relationships between those involved in the project.

A key challenge for anyone seeking to identify, categorize, and ultimately make use of the information captured through analysis of root causes of failure is that perceptions of failure are often subjective, and views of how and why a failure occurred (or even what constitutes a failure) differ across individuals (Edmonson, 2012). This poses the risk that an exercise to identify and address root causes of failure will only incorporate a limited subset of the information needed to gain a full understanding of how and why failure occurred and what should be done about it. This risk is particularly high when dealing with complex environments and diverse stakeholder constituencies for which multiple external factors may affect results (Edmonson, 2012), and conditions common to many conservation scenarios (Brechin et al., 2002). To help account for this, we recommend that those seeking to apply the taxonomy start by acknowledging that, in many cases, identification and analysis of root causes will primarily center around gathering and analyzing individual's perceptions of failure, both in relation to whether something is considered a failure and how and why it occurred, and that these perceptions may differ considerably between individuals and stakeholder groups depending on their role, knowledge, attitudes, or underlying motivations. The primary aim for those applying the taxonomy should therefore be to try and obtain, as much as possible, a holistic understanding from the information available, identify key knowledge, and make informed judgements on the most useful next steps. Furthermore, we advise that application of this taxonomy replicate practice in other sectors in which identification of generic root causes acts primarily as a starting point for further interrogation of the underlying reasons for failure, which may incorporate discussion or identification of other root causes or be highly context specific.

For example, in the taxonomy, root causes relating to relationships between those involved in the project (tier 1 categories 2 and 5) are broken down into different stakeholder groups (e.g., landowners, policy makers, project team, project and senior management). However, the taxonomy does not further categorize the reasons that these relationships proved problematic (e.g., language barriers, interpersonal relations, existing power dynamics), something that was highlighted by a number of those providing input during the testing phase. Ultimately, we did not incorporate this level of detail because we thought that reasons at this level could be applied equally to any of the identified stakeholder groups and that subsequent discussions on solutions would be best structured according to those stakeholder groups. For example, a solution for addressing dysfunctional interpersonal relations between policy makers would likely require a very different approach to one seeking to overcome dysfunctional interpersonal relations between members of a project team. Instead, the taxonomy provides practitioners with a list of high-level root causes relating to different stakeholder constituencies, for example, relating to levels of community support (5.2.3 in Table 1) or engagement of landowners (5.2.5 in Table 1) that can be used as a starting point for further interrogation and analysis. Such a process could then incorporate multiple perspectives from these and other relevant stakeholder groups. This process might involve adapting the language in the taxonomy, removing or expanding particular root causes, or employing an approach such as most significant change (Davies & Dart, 2005) or participatory impact assessment (Catley et al., 2013) to obtain a holistic understanding of how and why failure occurred. Similarly, a team that identifies theory of change (1.2.2. in Table 1) as a root cause of failure would be advised to gather a number of perspectives on why the project's theory of change ultimately proved inadequate, to avoid, for example, focusing analysis of the failure on very specific project components without questioning the project's overarching approach (Chambers et al., 2021). A further line of inquiry could focus on whether failure was preventable, complexity related, or "intelligent" (Edmonson, 2012). Applying the taxonomy in this manner provides users with a high-level framework to organize their thinking, analysis, and communication, while still allowing for further consideration of the reasons for failure, incorporation of multiple perspectives, and identification of potential solutions in line with the contextual requirements of the situation.

Building learning from failure into adaptive management cycles

Of all the potential applications of a taxonomy of root causes of failure, the most useful for many practitioners will be in supporting planning, implementation, evaluation, and adaptive management processes relating to specific conservation projects or project actions.

The ability to identify, learn from, and adapt practice in response to ineffective or counterproductive actions forms a core component of effective project cycle and adaptive management (Salafsky et al., 2001). Although use of adaptive management and related decision-support frameworks by conservation teams and organizations has increased considerably in recent years (e.g., CMP, 2020; Gregory et al., 2012; Margules & Pressley, 2000), there is evidence to suggest that there is still scope for improving the ability of these frameworks to support teams to achieve better conservation results.

For example, the CS (CMP, 2020) is one of the most widely applied frameworks for supporting conservation teams to complete the adaptive management cycle. A survey by Redford et al. (2018) asked respondents to assess the contribution of the CS to several attributes of project or program effectiveness. They found that many teams were failing to complete the adaptive management cycle in its entirety, despite application of the CS. Furthermore, the number of respondents stating that the CS had made a significant contribution to "ceasing ineffective actions" was lower than that for any other CS attribute considered, suggesting a potential gap in the existing CS framework around identifying when actions are failing to produce intended results and making changes to practice in response.

We propose that this taxonomy can play 3 particularly useful roles in assisting teams to practice good adaptive management. First, it prompts teams and individuals to consider potential or actual root causes of failure that may not have previously occurred to them, helping to address, in part, the various forms of cognitive bias that can influence individuals' ability to identify and acknowledge failure (see Catalano et al., 2018). Second, it helps practitioners summarize, collate, and analyze the results of discussions around how and why failure has or could potentially occur. And third, it keeps discussions around failure focused on root causes, helping to reduce the perceived risk for participants compared with exercises that focus solely on highly contextual information.

We suggest that a discussion around root causes of failure would be particularly useful at the following points in a project or adaptive management cycle. First, such a discussion would be useful during planning, at which point it may be more appropriate to relabel root causes as risks. Identifying and assessing risk forms a key component of many planning processes (Golini et al, 2015; Holling, 1978). When identifying and analyzing risk, the aim is typically to identify factors that could negatively influence the project's results, assess their potential impact, and then develop and deploy appropriate strategies for mitigation. However, the complexity inherent in many conservation scenarios poses significant challenges for many conservation teams completing this step. There are often a very high number of factors that could potentially pose a risk to the project, many of which may be unknown or beyond the control of the project team (Adams et al., 2014). Applying a taxonomy to this exercise could help prompt participants to identify risks they would not necessarily have considered or help in summarizing and collating identified risks from a general discussion or from multiple perspectives. The resulting analyses would provide a basis for identifying potential mitigation strategies.

Second, discussion of root causes of failure should occur during implementation, in order to gather information that can inform and improve current practice and increase the likelihood of achieving intended results. At this stage, the terms *challenges* or *issues* might be more appropriate than referring to failure explicitly. Pause-and-reflect sessions (USAID, 2018) and after-action reviews (Guadagno et al, 2021, USAID, 2015), adapted for use from the U.S. military, are relatively simple; require minimal investment in time, resources, and expertise; and can be easily inserted in existing project implementation processes. In their simplest form, both these tools ask participants to consider the following questions: What was expected to happen? What actually happened? What went well and why? What can be improved and how? As with assessing risks, the taxonomy could support teams in answering these questions by providing a reference point for considering a broad range of potential causes of failure and collating and summarizing the results to identify potential solutions. The taxonomy could also help form the basis of objective assessments by those outside the core team who are less likely to have psychological biases that can affect those evaluating their own work.

The third and final point is that a discussion around root causes is useful after the project has finished, when the term *failure* is more appropriate. Here, the aim is typically to document learning to inform future practice, either carried out by the implementing team or by others. As in previous steps, applying the taxonomy to such an exercise could help teams identify, synthesize, and communicate root causes and associated learning more effectively and in a way that can be more readily understood by others.

Directly considering all tier 3 root causes in a pause-and-reflect session or risk analysis might be too detailed an exercise for many teams. A sensible approach could involve prompting participants with the higher level categories (tiers 1 and 2) before proffering the more detailed (tier 3) categories, where appropriate, to collate and summarize the results. This would provide a useful starting point for further interrogation and discussion on underlying reasons for failure and for informing actions to mitigate, address, and learn from identified risks, challenges, and failures.

Because the taxonomy categories have many parallels with the steps in many existing project cycle and adaptive management frameworks, it could also help teams identify which stages of this cycle it would be useful to revisit in order to take action to mitigate, address, or learn from identified risks, challenges, or failures. Integrating the taxonomy with existing frameworks also ensures that its application complements and provides additional value to existing practice, rather than being seen as an additional step for teams to complete.

Conservation practitioners are more willing to engage in learning from failure behavior in environments in which they benefit from a high level of psychological safety (Catalano et al., 2021). We propose that framing learning from failure exercises around generic root causes minimizes the risk of participants adopting a "name, blame, and, shame" approach to failure in which practitioners are afraid to record, acknowledge, and share failure (Catalano et al., 2018; Edmonson, 2011; Reason, 2000), and provides a more direct route to potential solutions.

Supporting multiproject categorization and analysis of root causes

In addition to improving learning from failure through improved project and adaptive management, there is also much to be gained from better categorizing and summarizing the occurrence of different types of failure and the relationships between project characteristics and particular root causes.

Previous studies note a lack of standardization in the way conservation failures are reported, and many focusing on relating personal experiences rather than producing information that can inform future actions (Catalano et al., 2019). This limits efforts to gather, analyze, and summarize information from multiple cases and mainstream learning into the hands of those who would find it useful. Learning is also limited by the lack of appropriate platforms and resources to present and share information from failure; there are calls for increased collaboration around the recording, sharing, and analysis of failure (Catalano et al., 2019; Meek et al., 2015; Sanders et al., 2019). Our taxonomy could help overcome this constraint by facilitating development of standardized methods for recording, analyzing, and summarizing information resulting from failure. For example, the taxonomy can inform the design of and maintenance processes for repositories of information on failures or guide further classification and organization of existing repositories containing information on what has and has not worked, in much the same way existing repositories have used the current International Union for the Conservation of Nature threats and actions taxonomies to categorize other forms of information resulting from conservation action (e.g., Sutherland et al., 2019). In doing so, our taxonomy of root causes of failure could help practitioners who are not in close contact with one another to learn from past mistakes to decrease the chance of making similar errors in subsequent practice.

The taxonomy could be similarly applied to collation and analysis of information across teams and organizations to identify potential solutions for generic and widely encountered challenges. For example, as the most frequently encountered root cause across our test data set (Table 2) suggests, many projects may benefit from investing in the development and subsequent validation of a strong, well-thought-out theory of change in order to avoid failure (1.2.2 in Table 1). Our exploratory analysis also suggests that projects with a species management component may benefit from ensuring they have the necessary ecological knowledge inputs to project planning (1.1.1 in Table 1) and that relevant case studies and examples might be more easily found by looking at other species management interventions than other conservation action types. Because it is rarely feasible for project teams to develop mitigation strategies for every root cause of failure that may occur, this information could help conservation practitioners identify and prioritize the development of strategies for avoiding specific root causes based on their prevalence in projects implementing similar conservation actions.

Although our conclusions apply only to the test sample, we propose that a similar analysis, or one that simply aggregates and ranks the most common root causes, applied to other portfolios of projects would provide a useful starting point for discussions around potential solutions. Further expanding the number of test cases would improve the validity of any conclusions drawn from such an analysis.

Operationalizing learning from failure in conservation

If developing and applying appropriate tools, methodologies, and protocols represents one of the enabling conditions required to facilitate learning from failure in conservation, then another is to ensure that the operational culture that these tools are applied in facilitates their use. Recent research highlights the importance of psychological safety in ensuring practitioners' willingness to engage in learning from failure behavior (Catalano et al., 2021). There are also potential pitfalls in attempting to apply some of the practices for learning from failure common in other sectors to particular conservation scenarios (Chambers et al., 2021). A key barrier to learning from failure is that currently many people working in conservation have limited incentive to do so. In many cases, the conservation donor culture is more likely to reward those who can best demonstrate success, rather than those who can demonstrate effective recording and analysis of and learning from failure (Lamoreux et al., 2014). If funders asked grantees to identify, report, and act on failures based on a common taxonomy, this would allow for information from both single and multiple projects to be gathered, summarized, and used to analyze the conditions in which failures most often occur and how these could be dealt with in future. This kind of exercise, particularly if carried out anonymously, could help generate more useful information than is often received by asking project teams directly for examples of failure and lessons learned, which places the onus on the project team to define failure and communicate it in a way that will be viewed positively by the audience (Lamoreux et al., 2014; Redford & Taber, 2000).

Effective learning from failure in conservation requires the time, space, and security to reflect, gather information from a number of perspectives, and make informed judgements based on the resulting information. A lack of these core conditions represents a key limiting factor at all levels of conservation (project teams, organizations, funders, etc.) in efforts to record and learn from failure. Much conservation funding is short term and used to carry out immediate and urgent action, with subsequent reporting and accountability focused on demonstrating that the action was carried out as described (Lamoreux et al., 2014). Consequently, almost every initiative that requires thinking time for practitioners ends up having to make trade-offs between the level of thinking required and the need to demonstrate that action has been delivered. The fact that funding cycles are short term also means that funders have limited time or scope to adequately pause, reflect on the information provided to them by grantees, and synthesize this in way that can be used to inform practice.

Many other sectors have developed their own distinct culture around learning from failure. For example, in aviation the primary focus for identification and analysis of failure is to reduce the risk of catastrophic failure and subsequent loss of life (Birkland, 2004). For technology start-up companies, the focus is often more on innovation and "failing forward" (Bajwa et al., 2017), whereas learning from failure in manufacturing often centers around eliminating inefficiencies in the production process (Liker, 2004; Seddon & Caulkin, 2007). Given the current interest in improving learning from failure in conservation, there is much to be gained from further considering how conservation stakeholders can develop the necessary operational culture that fosters learning from failure, while avoiding any potential pitfalls.

For conservation to embrace failure as an essential part of the learning process will require a culture shift from stakeholders across the sector. Establishing communities of practice that utilize standardized recording and analysis of the root causes of failures, as part a wider culture of learning that prioritizes and facilitates reflection, sharing, and adaptation, could lead to significant improvements in the design, implementation, and impact of conservation practice. Funders and grant givers could further enhance this by encouraging, incentivizing, and rewarding projects and organizations that can demonstrate effective learning, even when conservation efforts fail.

Although careful consideration needs to be given to how specific approaches for learning from failure can best be applied to conservation efforts, evidence of the advances made by other sectors after successfully embracing failure as a learning tool suggests that many solutions to current failures in safeguarding the planet's biodiversity are likely to come from analysis of the root causes underpinning these failings. A taxonomy of root causes will not address all the barriers that currently limit learning from failure in conservation. However, we propose that our taxonomy, applied in conjunction with simple methodologies for data collection, analysis, reflection, and adaptation, can provide a useful means to help facilitate the transition required. Given the current scale of the biodiversity crisis, this is an opportunity for learning that cannot be ignored.

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SUPPORTING INFORMATION

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

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