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Abstract

Conservation practitioners are increasingly interested in the lessons gained through failure. While other 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. In this paper we propose 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, extracted their underlying root causes of failure and used these to develop a generic, three-tier taxonomy of the ways in which projects fail. We subsequently 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 relationships between particular root causes and the types of conservation actions being implemented within this test sample, which suggested that some root causes may be more likely to be reported in projects implementing particular types of conservation action, while others may frequently occur across a

range of different project types. We propose that this taxonomy could be used to help improve identification, analysis and subsequent learning from failed conservation efforts, help address some of the barriers that currently limit the ability of conservation practitioners to learn from failure, and contribute to establishing an effective learning from failure culture within conservation.

Introduction

The need for a culture shift

Despite some notable conservation successes (Temple, 1986; Sodhi et al., 2011; Zerbini et al., 2019), the 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 towards the lessons that can be gained through failure as a means of improving conservation results and impact.

All initiatives carried out within complex environments should expect to experience failure (Hickey et al. 2015, Catalano et al. 2018), 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).

While it is possible to find examples of failure in conservation (Varnham et al., 2002; Turvey, 2008) these are rarely well documented with in-depth examination of how and why failure occurred and how it could be avoided in future. A recent paper reviewed the published literature for cases of failure in conservation (Catalano et al., 2019). While the review found several examples of published conservation failures, overall these were relatively few and most lacked standardization. Of the cases identified, 71% of lead authors were affiliated with an academic institution with only 8% and 7% affiliated with NGOs or government agencies respectively. Given that non-academic institutions (primarily NGOs and government agencies) 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/organization, and sometimes not at all. The review authors suggested that 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 which can demonstrate significant progress resulting from the adoption of a culture of systematically recording, discussing and learning from failure (Schulz, 2010; Syed, 2016; Catalano et al., 2018).

Nothing less than a culture shift is needed. While it is true that conservation often takes place in highly complex, dynamic and changing environments, where practitioners often lack time and resources, we 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).

While 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 aim to contribute to establishing such enabling conditions by: (1) proposing a taxonomy of root causes of failure in conservation; (2) demonstrating its application to a sub-set of real-life conservation interventions that were perceived to have failed in some way, and (3) proposing further opportunities for applying the taxonomy to help improve practice and remove barriers to learning from failure in conservation.

The 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, 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., 2007) 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 accident 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 (NCSA, 2020; 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, allowing 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 that those in conservation don’t record and publish failure, ranging from human psychology to external constraints and influences (Redford & Taber, 2000; Lamoreux et al., 2014; Catalano et al., 2018). While the creation of a taxonomy of root causes will not be sufficient to fully establish a culture of learning from failure, we consider it to be 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 using examples from participating organizations of real-life conservation interventions that were considered to have failed in some way. When gathering examples, we defined failure simply as a lack of success at delivering stated objectives or outcomes. We adopted this broad definition to reflect the view that failure is subjective, that different individuals may have different perceptions of what constitutes failure (Edmondson, 2012) and that in many cases, failure and success will not be binary outcomes, but instead graded along a continuum of partial success and partial failure. A broad definition of failure therefore allowed discussion to move quickly onto reasons and root causes, minimizing the risk of becoming overly focused on whether an example constituted a failure or not.

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 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 studies have highlighted 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 three primary concerns that influenced the protocol for gathering examples from participating organizations. The first concern was that information collected would be biased towards certain types of failure (e.g., examples of “heroic failure”, where an intervention was perceived to fail initially but could ultimately be spun as a success due to the efforts of the project team). The second 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 third concern was that the method of collecting information was likely to have a considerable effect on the quantity and quality of responses. Previous studies have noted that published accounts of failure in conservation are rare (Catalano et al., 2019), and often include limited analysis of how and why failure occurred and how it could be avoided in future. Therefore, we wanted 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, between April-May 2019, identified colleagues who had been involved in conservation projects that those colleagues considered to have failed in some way. 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 which subsequently arose as a result of an ultimate cause). However, we allowed respondents to define themselves what they perceived to be the ultimate/root causes in each case, acknowledging that an ultimate/root cause of failure identified by one 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 collated all root causes as a single list without revealing where the example originated. In June 2019, we convened a workshop where 21 participants from 14 conservation organizations and three academic institutions, used the list of examples to develop a three-tier taxonomy of root causes of failure. This involved grouping root causes under broad categories and then refining the language further to reflect generic root causes, rather than specific examples. After the workshop, the taxonomy went through several rounds of review and revision to refine the language and to insert/delete causes that were felt to be missing or superfluous.

This protocol addressed our first and second 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 of the organization providing the example to identify specific projects, individuals or organizations. The protocol addressed our third 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, with resulting feedback 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/Water Management; Species Management; Awareness Raising; Law Enforcement; Livelihoods; Developing/Implementing Policy Frameworks; Planning/Designation; Research/Monitoring; Education/Training; Institutional Development; see Salafsky et al., 2007). Participants could select more than one 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, as well as reaching out to individuals within other conservation organizations, funders and practitioner networks. The test phase ran from August 2019 to September 2020 with all responses submitted during that time included in the subsequent analysis.

Analysis of patterns / 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 each project, and the frequency of occurrence of different root causes for both the highest and lowest tier of the taxonomy (tiers **1.** and **3.**).

In addition, we undertook a further, exploratory analysis to determine whether projects implementing particular conservation action types were more or less prone to specific root causes of failure. To do this, we ran two sets of Chi-squared tests. The first, using the entire response dataset, assessed the degree of association between reporting of a particular root cause, and whether the project implemented a particular conservation action type, this provided an indication of whether the root cause had a positive or negative association with the action type when compared with other action types. For the second, we ran separate chi-square tests for each conservation action type, assessing whether there was a significant difference in the frequency of reported failures by projects implementing the action type in question, providing an indication of whether the root cause was more or less common within that action type.

We applied the commonly used significance threshold of 2 standardized residuals. For example, in projects with a species management component, an association (x-axis) value >2 indicates that a particular root cause of failure was significantly more likely to be reported by projects that included a species management component than those that did not, while a frequency (y-axis) value of >2 indicates that that a particular root cause was is significantly more likely to be reported than other root causes of failure (by projects with a species management component).

Results

Taxonomy Development

Fourteen participating organizations submitted 286 “root causes”. The resulting taxonomy, shown in Table 1, groups root causes using a three-tier hierarchy. Although not our original intention, the resulting categories have many parallels with the plan – implement – learn & adapt steps which underpin many project cycle/adaptive management frameworks (Add example).

Table 1: Taxonomy of Root Causes of Failure affecting Conservation Projects. Each over-arching category (e.g. 1. Planning, Design or Knowledge) is divided into a number of mid-level categories (e.g. 1.1 Knowledge inputs to project design) which are further divided into specific root causes (e.g. 1.1.1. Ecological Knowledge) each of which are accompanied by a description and a relevant example. The number of decimal places denotes the taxonomy rank.

Root Cause of Failure	Description	Examples
1. Planning, Design or Knowledge	Root causes of failure in this section relate to the way that 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/socio-economic 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)	The mechanism for addressing the problem proved insufficient and/or inadequate 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 change(s) 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/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 of the proposed activities
Setting of clear goals and objectives		
1.2.5. Setting of realistic goals/objectives etc.	Setting goals/objectives beyond what could be realistically delivered with the time/resources available	A 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
1.2.6. Technology or methodology used	Using inappropriate and/or inefficient methods, techniques and/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/expertise of departing staff was not captured or passed onto newly recruited staff
Long-term model for financial sustainability		
1.3.2. Exit strategy	Lacking a clear plan for disengaging from 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/input during design phase from relevant stakeholder groups	Awareness raising workshops designed in the wrong language
2. Team Dynamics	Root causes in this section primarily relate to relationships and dynamics within project teams For failures relating to the way that projects are structured See Section 3. Internal Governance Structures For failures due to relationships with and between those involved or impacted by the project but are not part of the core, implementing team see Section 5: Stakeholder Relationships	
2.1 Project management and/or supervision		

2.1.1. Leadership/supervision of project staff by project manager(s)	Project management not providing effective support, supervision or guidance	Lack of engagement/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 and/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/buy-in from senior management to the project team	Senior management did not feel that 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 non-essential 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/values among project team	Lack of/change in understanding by those involved in the project on what the project should be doing, what the priorities are and/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 and/or employed by the implementing organization	Project staff found to be participating in the illegal practices that the project was trying to prevent

3. Internal Governance Structures	Root causes in this category relate to the way that conservation projects are structured, Particularly, their levels of governance and systems/procedures for communicating information between these. For failures relating to relationships between those involved in the project see Section 2. Team Dynamics and Section 5. Stakeholder Relationships	
3.1. Project Governance Structures		
3.1.1. Management/governance structures lacking key elements	Elements of project management and/or governance structures either missing and/or not functioning effectively	Project did not set up technical advisory group to oversee running of the project
3.1.2. Clarity of roles/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 the 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/mismanagement		
3.2.1. Systems for identifying and dealing with risk/mismanagement (e.g. corruption)	The project lacked the proper structures and procedures necessary to identify and deal with risk and/or 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	Root causes in this category relate primarily to the existence and availability of resources For mismanagement of resources see Section 2. Team Dynamics	

4.1. Funding		
4.1.1. Funding delays	Delay(s) in receiving funding from donors/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 co-funding	Project did not receive/raise co-funding 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 and/or resources	Unable to ensure continuity of funding/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	Over-committed and/or over-stretched staff leading to key targets being missed
4.2.3. Administrative burden	Burden of administration (e.g., reporting, financial management, recruitment etc.) negatively affected implementation	Fulfilling reporting requirements took up a disproportionate amount of project staff time which 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/capabilities required for effective delivery
4.2.5. Ability to maintain sufficient expertise	Loss of essential knowledge/skills/experience and inability to effectively replace this	Unable to replace departing staff with others with the required level of skills/experience
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/materials used in the project not maintained to the level required	Project vehicle broke down due to lack of maintenance meaning that staff couldn't visit project sites

5. Stakeholder Relationships	Root causes in this category relate to relationships with and between key stakeholders that are involved in the project but are not part of the core, implementing team (e.g., local authorities, communities, collaborating organizations) For issues relating to relationships within project teams see 2. Team Dynamics	
5.1. Funder support		
5.1.1. Funder support	Loss of, change in or disconnects in support and/or engagement by the project funder	Funder was 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 / decision-makers	Lack of support/buy-in from **existing** relevant government agencies/individuals	Government officials unwilling to support a change in the law proposed by the project
5.2.2. Change in key government bodies / decision-makers	Loss of/inability to ensure continuity of existing support resulting from a change in relevant government agencies/individuals	An election in the middle of the project meant that 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	The project team were 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	The 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/carried on the damaging practices the project was trying to stop
5.2.5. Engagement of land-holders	Lack of support from stakeholders owning/controlling land relevant to the project Or Loss of/inability to ensure continuity of existing support from stakeholders owning/controlling land relevant to the project	Local landowners were not willing to adopt the land management practices being promoted by the project
5.2.6. Ability to build/catalyze support from general public	Inability to build support from general public in relation to the project's conservation goals	Project was unable to communicate a compelling, easily understood narrative to gain public support

5.2.7. Engagement with relevant allied stakeholder organizations	Dysfunctional/non-existent relationships with stakeholder organizations supportive of the project's aims and/or working to achieve similar outcomes	Poor engagement/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/non-existent relationships with stakeholder organizations not supportive of the project's aims and/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
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	Root causes in this category relate to external events that can't be predicted and/or influenced by the project	
6.1. Environmental events		
6.1.1. Climate/weather	Climatic conditions and/or weather events	Floods, droughts, hurricanes, tornadoes
6.1.2. Other natural disasters	Failure due to natural disasters other than those caused by weather/climate	Earthquakes, volcanic eruptions, tsunamis
6.1.3. Wildlife disease	Failure due to diseases affecting wildlife (either directly affecting species targeted by the project or other non-targeted species which affected the project in some way)	Botulism outbreak affecting waterbird populations, respiratory disease in ungulate populations
6.2 Human Events		
6.2.1. Conflict/insecurity	Failure due to conflict and/or insecurity	Civil unrest restricted access to project sites
6.2.2. Disease affecting humans and/or domesticated animals or plants	Failure caused by cases or outbreaks of diseases affecting humans and/or domesticated animals and/or plants	Ebola epidemic restricted access to project sites, Covid-19 pandemic

Taxonomy Testing and Application

The test phase captured information from 122 projects, reporting 905 root causes in total.

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 (Fig. 1). No significant gaps or redundancies were highlighted during the testing phase. The final wording of tier 1 categories 2. and 5. (see Table 1.) were modified slightly based on participant feedback (from “Implementation” and “Relationships with External Stakeholders” 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 had 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 the root cause(s) related to relationships between those involved in the project (see discussion).

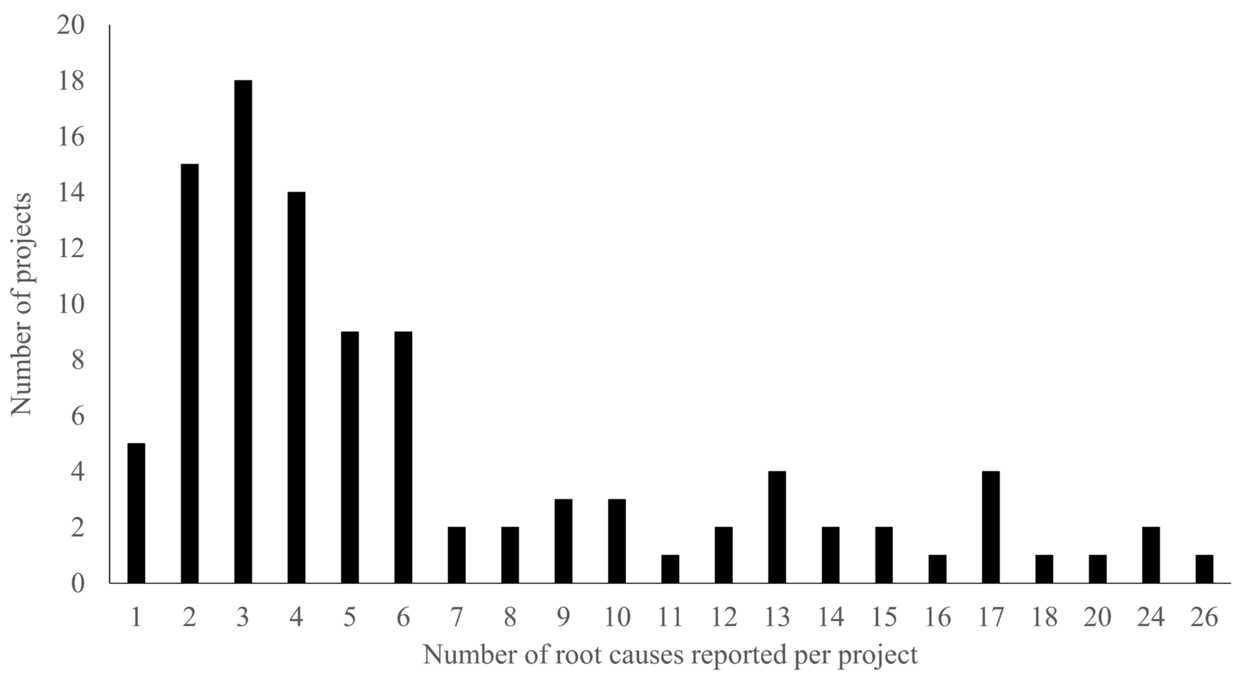

Figure 1: Distribution of number of root causes reported per project

Most frequently reported root causes

Root causes due to Planning, Design or Knowledge were the most frequently reported in the test sample (82% of projects). Root causes due to Stakeholder Relationships (60%), Resources (50%) and Team Dynamics (48%) were also frequently reported, while root causes relating to Governance Structures (30%) were reported slightly less frequently and those relating to unexpected External Events the least reported (15%). See Appendix 1 for the same information for tier three root causes.

Analyzing association between root causes and conservation action type

		Significant reporting frequency	
		Significant association	Non-significant/No association
		Frequently reported, more likely to be reported by projects implementing corresponding action type	Frequently reported, not more likely to be reported by projects implementing corresponding action type
Conservation Action Type	Land / Water Management (n=30)	5.2.5. Engagement of Landowners	1.2.2. Theory of Change 4.2.2. Staff Workload 5.3.1. Conflicting Agendas 3.1.1. Governance Structures Lacking
	Species management (n=51)	1.1.1. Ecological Knowledge 1.1.4. Evidence of Approach	1.2.2. Theory of Change 4.2.4. Technical Expertise 2.1.3. Adaptive Management 4.2.2. Staff Workload 5.2.1. Government Support
	Awareness (n=25)	-	1.2.2. Theory of Change 2.1.3. Adaptive Management 3.1.1. Governance Structures Lacking 5.3.1. Conflicting Agendas
	Law Enforcement (n-14)	-	5.2.1. Government Support 5.3.1. Conflicting Agendas 1.2.2. Theory of Change 2.1.4. Support from senior management 5.2.3. Community Support
	Livelihood, economic & moral incentives (n=14)	-	4.2.4. Technical Expertise 5.2.3. Community Support 3.1.1. Governance Structures Lacking 1.2.2. Theory of Change
	Policy Frameworks (n=14)	-	1.2.2. Theory of Change 5.2.1. Government Support 5.3.1. Conflicting Agendas
	Planning / Designation (n=28)	2.2.2. Staff Communication	5.3.1. Conflicting Agendas 1.2.2. Theory of Change 3.1.2. Roles (governance) 2.1.6. Coordination 5.2.1. Government Support 5.2.7. Support from Allied Stakeholders 4.2.2. Staff Workload
	Research & Monitoring (n=27)	1.2.5. Realistic Goals 1.4.1. Stakeholder Engagement (during planning)	1.2.2. Theory of Change 1.1.4. Evidence of Approach 2.1.1. Supervision (by project manager) 1.3.2. Exit Strategy 2.2.3. Values (project team)
	Education / Training (n=20)	-	5.3.1. Conflicting Agendas 4.2.4. Technical Expertise 1.2.2. Theory of Change 5.2.7. Support from allied stakeholders 1.4.1. Stakeholder engagement (during planning) 2.1.3. Adaptive Management 2.2.3. Values (project team)
	Institutional Development (n=10)	4.1.3. Co-funding^	3.1.1. Governance Structures Lacking 2.1.1. Supervision (by Project Manager) 1.2.2. Theory of Change

Table 3: Root Causes significantly more likely to be reported by projects implementing a particular conservation action type, divided into root causes that were/were not significantly associated with the corresponding conservation action type. Significance based on standardized Chi squared residual values. Results >2 indicate significance (^ denotes categorization based on <5 responses)

The overwhelming majority of root causes were not found to be significantly associated with a particular conservation action type and not significantly more or less likely to be reported than other root causes.

Notable exceptions are highlighted in Table 3. For example, failure due to insufficient or inadequate ecological knowledge (1.1.1) and from lacking sufficient evidence on the effectiveness of the proposed solution (1.1.4.) were both significantly more likely to be reported by projects which included a Species Management component and were significantly more likely to be reported by these projects than other root causes. Similarly, failure due to engagement of landowners (5.2.5) was significantly more likely to be reported by projects which included a Land/Water Management component and was significantly more likely to be reported by these projects than other root causes. Conversely, a number of root causes were not found to be significantly associated with a particular action type but were instead found to be significantly more likely to be reported across a number of different action types. For example, failures relating to Theory of Change (1.2.2) were significantly more likely to be reported than other root causes across all conservation action types, while failure due to conflicting agendas among project stakeholders (5.3.1.) was significantly more likely to be reported than other root causes by projects implementing actions relating to Land / Water Management, Raising Awareness, Law Enforcement, Policy Frameworks, Planning & Designation and Training & Education.

Discussion

Taxonomy completeness and applicability

Aside from those added later, 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, less than 5% of projects reported a single root cause of failure (Table 2). This suggests that a failed conservation effort often has multiple root causes, which may be inter-related. This has much in common with the IUCN/Conservation Measure Partnership (CMP) threats and conservation actions classifications (Salafsky et al., 2007) where multiple inter-related threats may affect a target and require multiple inter-related actions to address.

Of those who provided a response, all those who participated in 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 exception to this was around a sub-set of reasons relating to certain relationships between those involved in the project, which are dealt with in the discussion below.

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 sub-set of the information needed to gain a full understanding of how and why failure occurred, and what should be done about it. This is particularly relevant when dealing with complex environments and diverse stakeholder constituencies where multiple external factors may impact results (Edmonson, 2012), 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/why it occurred. Further acknowledging that these perceptions may differ considerably between individuals and stakeholder groups depending on their role, knowledge, attitudes or underlying motivations and that the primary aim of the exercise should be to try to obtain a holistic understanding from the information available and to use this to make informed judgements on the most important lessons learnt, and potential next steps.

Furthermore, we advise that application of this taxonomy replicates practice in other sectors where 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.** & **5.**) are broken down into different stakeholder groups (e.g. landowners, policymakers, project team, project/senior management). However, the taxonomy does not further categorize the reasons that these relationships proved problematic (e.g. language barriers, inter-personal 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 it was felt 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 inter-personal relations between policymakers would likely require a very different approach to one seeking to overcome dysfunctional inter-personal 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.) or engagement of landowners (5.2.5.) 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 alternative approach such as Most Significant Change (Davies & Dart, 2004) 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.) 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 over-arching 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 organise 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 the project/adaptive management cycle

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 (Runge, 2011). While use of adaptive management and related decision-support frameworks by conservation teams and organizations has increased considerably in recent years (e.g. Margules & Pressley, 2000; Gregory et al., 2012; CMP, 2020), there is evidence to suggest that there is scope for improving the ability to these frameworks to support teams to achieve better conservation results.

For example, the Conservation Standards (CMP, 2020) (hereafter: the CS), is one of the most widely applied frameworks for supporting conservation teams to complete the adaptive management cycle. A survey by Redford et al (2017) asked respondents to assess the contribution of the CS to several attributes of project or program effectiveness. The study 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 the lowest of all the attributes tested, suggesting a potential gap in the existing Conservation Standards framework around identifying when actions are failing to produce intended results and taking subsequent action to adapt.

We propose that this taxonomy can play three particularly useful roles in assisting teams to practice good adaptive management. First, in prompting team and individuals to consider potential or actual root causes of failure that may have not previously occurred to them, helping to address, in part, the various forms of cognitive bias that can influence individual’s ability to identify and acknowledge failure (see Catalano et al,. 2017). Second, in helping to summarize, collate and analyze the results of discussions around how and why failure has, or could potentially occur. And third, in keeping discussions around failure focused on root causes, helping to reduce the perceived risk for participants compared to exercises which 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 the project/adaptive management cycle:

1) During planning, where it may be more appropriate to relabel root causes as “risks”. Identifying and assessing risk forms a key component of many planning processes (Holling, 1978; Golini et al, 2015). 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 which could potentially pose a risk to the project, many of which may be unknown or beyond the ability of the project team to control (Adams et al, 2015). Applying a taxonomy to this exercise could help prompt participants to consider and identify risks they would not necessarily have considered and/or help to play a role in summarizing and collating identified risks from a general discussion or from multiple perspectives, with the resulting analysis providing a basis for identifying potential mitigation strategies.

2) During implementation, where the primary motivation is to gather information that can inform and improve current practice, increasing 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 (USAID, 2015, Guadagno et al 2021) are two tools, adapted for use from the US military, which are relatively simple, require minimal investment in time, resources and expertise, and can be easily inserted into existing project implementation processes. In their simplest form, both of these tools ask participants to consider the 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 to answer these questions by providing a reference point for considering a broad range of potential causes of failure and collate and summarize the results in order 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 suffer from the psychological biases that can affect those evaluating their own work.

The final point where a discussion around root causes is after the project has finished, where 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 to more effectively identify, synthesise and communicate root causes and associated learning, in a way that can be more readily understood by others than a purely contextual case study.

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, so a sensible approach could involve prompting participants using the higher level categories (Tiers 1. & 2.), before using the more detailed (Tier 3.) categories to collate and summarize the results of this more general discussion, with root causes identified using the taxonomy providing a starting point for further interrogation and discussion on underlying reasons for failure and to inform actions to mitigate, address and learn from identified risks/challenges/failures.

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

Recent research indicates that conservation practitioners are more willing to engage in learning from failure behavior in environments where they benefit from a high level of psychological safety (Catalano et al. 2021). A psychologically safe meeting is one in which individuals are able to speak freely about their mistakes and concerns without fear of blame, retribution, or embarrassment (Catalano et al,. 2017). We propose that framing such meetings around generic root causes minimizes the potential for participants to adopt a name, blame and shame approach to failure, where practitioners are afraid to record, acknowledge and share failure (Reason, 2000; Edmonson, 2011; Catalano et al. 2018), and which provides a more direct route to potential solutions.

Informing multi-project analyses of root causes to inform solutions

In addition to improving learning from failure through improved project/adaptive management, there is also much to be gained from further investigating and summarizing the frequency that certain failures occur, and the relationships between project characteristics and particular root causes.

Previous studies have noted a lack of standardization in the way that conservation failures are reported, with many focusing on relating personal experiences rather than producing information that can inform the reader's 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, with several authors calling for increased collaboration around the recording, sharing and analysis of failure (Catalano et al., 2019; Sanders et al., 2019; Meek et al., 2015). This taxonomy could help overcome this constraint by facilitating development of standardized methods for recording, analyzing and summarizing information resulting from failure, and to inform and structure processes and methods that conservation teams and organizations build into their operational practices to identify and deal with failure. For example, by helping to design and maintain repositories cataloguing information from failures, or by helping to further classify and organize existing repositories containing information on what has and hasn't worked, in much the same way that these repositories have used the current IUCN threats and actions taxonomies to categorize other forms of information resulting from conservation action (e.g. Sutherland et al., 2019).

In doing so, a 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. One potential application of the taxonomy is therefore in guiding collation and analysis of information across teams and organisations to identify potential solutions for generic and widely encountered challenges. Our preliminary analysis shown in Table 3 suggest that some root causes may be more likely to be reported in projects implementing particular types of conservation action, while others may frequently occur across a range of different project 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.

For example, our analysis suggests that projects with a Species Management component should ensure that they have the necessary ecological knowledge inputs to project planning (1.1.1.), and that relevant case studies and examples might be more easily found by looking at other Species Management interventions than other conservation action types. Projects that include a Research & Monitoring component or a Land Management component could be advised to take similar action in relation to stakeholder engagement during planning (1.4.1.) and engagement of landowners respectively (5.2.5.). Our analysis also indicates that many projects, regardless of the conservation actions they are implementing, 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.) and that several others may benefit from additional investment in establishing and maintaining a common agenda between project stakeholders or developing mitigation strategies for when conflict arises (5.3.1.).

While the conclusions drawn from this analysis only apply to this test sample, we propose that a similar analysis, or one which simply aggregates and ranks the most common root causes, applied to other sub-sets or portfolios of projects would provide a useful starting point for a discussion 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 practitioner's 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 in conservation have limited incentive to do so. In many cases, the conservation donor culture is more likely to reward those that can best demonstrate success, rather than those that can demonstrate effective recording, analysis and learning from failure (Lamoreux et al., 2014).

Funders asking grantees to identify, report and act on failures based on a common taxonomy would allow for information from multiple projects/portfolios 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 learnt, which places the onus on the project team both to define failure and communicate it in a way that will be viewed positively by the audience (Redford & Taber, 2000; Lamoreux et al., 2014).

Effective learning from failure in conservation requires, above all, 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, at the same time, much conservation funding is sought based on the secure resources to carry out immediate and urgent action, and subsequently demonstrating that this action has been carried out as described. 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 within these parameters. The fact that funding cycles are short-term also means that funders also have limited time or scope to adequately pause, reflect on the information provided to them by grantees and to synthesize this in way that can be used to inform practice.

Many of the other sectors mentioned in this paper 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) while learning from failure in manufacturing often centres around eliminating inefficiencies in the production process (Sneddon & Culkin, 2008). 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.

Conclusions

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 ultimate impact of conservation practice. Funders and grant-givers could further enhance this by encouraging, incentivizing and rewarding those projects and organizations who can demonstrate effective learning, even when conservation efforts fail.

While 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 suggest 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 we cannot afford to ignore.

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