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The role of social and political factors in the success of rewilding projects

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The ecological aspects behind the success and failure of rewilding projects have been looked at in literature and case studies, but rarely have sociopolitical factors been included in these classifications. To truly determine which factors lead to success in rewilding projects, inclusive of sociopolitical factors, we created global models that analyze 120 case studies from IUCN's "Global Re-introduction Perspectives" that fit under IUCN's definition of rewilding. Models included the ten guiding principles for rewilding from IUCN's Rewilding Thematic Group, success factors, and threats to success as defined from existing literature. We measured the self-reported "level of success" from the case report examples against the guiding principles, success factors and threats to determine which were more likely to be associated with successful rewilding projects. Local awareness of the benefits of rewilding and illustrating a proof of concept of rewilding were the factors that were most strongly associated with higher levels of success in rewilding projects, as self-reported by case report authors, as well as Guiding Principle 9 "rewilding recognizes the intrinsic value of all species". Our results indicate that both ecological and sociopolitical factors are critical to successful rewilding projects and both need to be accounted for and included in future planning of rewilding projects to maximize the possibility of successful rewilding.

KEYWORDS

rewilding, reintroduction, conservation translocation, social science, success, policy, human-wildlife conflict

1 Introduction

Rewilding is defined by the International Union for the Conservation of Nature (IUCN) as "the process of rebuilding, following major human disturbance, a natural ecosystem by restoring natural processes and the complete or near complete food web at all trophic levels as a self-sustaining and resilient ecosystem with biota that would have been present had the disturbance not occurred…" (Carver et al., 2021). One of the activities that falls under the umbrella of rewilding, if done with the intention of restoring natural

processes to a landscape, is reintroducing "lost" species (native species that were formerly present in a landscape but have been extirpated by humans) (Lipsey et al., 2007; Brown et al., 2011; Seddon et al., 2014; Andrews et al., 2022). For the purposes of this paper, we focus specifically on rewilding through species reintroduction, as opposed to any of the other methods of rewilding that include activities like passive land abandonment, island taxon replacement, etc. Rewilding through reintroduction intends to recreate ecologically appropriate trophic interactions that have been missing since their extirpation (Sandom et al., 2020). Despite the great promise of restoring natural ecosystem processes rewilding projects do not always succeed. The ecological aspects behind the success and failure of rewilding projects have been thoroughly assessed (Torres et al., 2018). However the sociopolitical factors associated with rewilding, which have strong implications for the success or failure of rewilding projects (Estrada, 2014; Lorimer et al., 2015; Coz and Young, 2020), are often overlooked.

Rewilding has an inherently ecological focus, which is reflected in the literature, however rewilding also affects human social and political issues which can ultimately influence whether rewilding activities succeed or fail (Pettorelli et al., 2018; Wolf and Ripple, 2018; Martin et al., 2021). The most recent definition from IUCN's Rewilding Thematic Group, used above, includes human and societal factors, such as looking at local engagement and support and the perceived intrinsic value of wildlife (Carver et al., 2021). When looking at rewilding in practice and outside of academic literature, these factors appear frequently in case reports (Soorae, 2008; Soorae, 2010; Soorae, 2011; Soorae, 2013; Soorae, 2016; Soorae, 2018; Torres et al. 2018; Sandom and Wynne-Jones, 2019; Soorae, 2021; Underwood et al., 2022), but they have not made it into the scientific literature. It is clear that social and political factors, such as human wildlife conflict, have effects on the success of rewilding projects, yet they are seldom measured in comparison to ecological indicators of success (Pettorelli et al., 2018; Vasile, 2018; Sandom et al., 2019; Coz & Young, 2020). For example, Torres et al. (2018) was the first to establish a set of indicators to measure rewilding progress but did not include any social or political indicators. The authors instead looked specifically at the level of human management of the landscape, and amount of ecological integrity in rewilded systems as indicators of success – leaving out social and political enabling conditions and their potential to influence project outcomes.

Despite potentially providing benefits for people and nature, public opposition around the potential for human-wildlife conflict, as well as other cultural and social issues, has caused many rewilding projects to fail if those issues are not resolved (Lorimer et al., 2015; van der Zanden et al., 2018; Martin et al., 2021). While physical damage caused by wildlife is usually cited as the main reason for conflict (Carver, 2017; Bavin et al., 2020, p. 201; Coz and Young, 2020), oftentimes there is significant conflict between people and wildlife that remains even if the physical damage has been reduced or eliminated. In addition to conflicts between people and wildlife, there are often conflicts between people (human-human conflict) that cause a project to fail. For example, in Norway, farmers suspected that 'naturally recolonizing' wolves were actually secretly bred and reintroduced (Dickman, 2010). In this case, farmers blamed external agencies for imposing wildlife and the risks associated with wildlife upon them – a trust human-human conflict (Dickman, 2010). Such conflicts between people also extend to anticipated conflict from animals if rewilding does occur. The likelihood of perceived [or anticipations of] conflict is particularly high if the species has been absent from a landscape for hundreds of years, which increases the potential to impede rewilding projects' progress because conflicts do not yet exist and must be anticipated (Auster et al., 2020). If not properly addressed human-wildlife conflict and other problems between people and wildlife, as well as between people, can ultimately diminish the benefits that rewilding can provide.

Media portrayals of Eurasian beaver (*Castor fiber*) rewilding in Europe (Kaphegyi et al., 2015), and grey wolf (*Canis lupis*) rewilding in Colorado (Niemiec et al., 2020) have focused mainly on reporting conflicts between people and the named species, and the potential for more conflict should the natural range of the species expand – a major goal of rewilding. The focus on conflicts in mainstream media has caused public perceptions of the rewilding of these species to become increasingly negative, perpetuating concerns over the potential loss of livelihoods, and threats to safety, should these species return to the landscape c. Thus, arguments for rewilding need to be articulated clearly enough to prevent conflict from occurring.

Building on Torres et al. (2018) indicators of ecological success for rewilding projects, Segar et al. (2022) developed a set of key success factors and threats to success that include both ecological and social attributes. Segar et al. (2022) conducted a mixed methods approach of utilizing ecological indicators from Torres et al. (2018), and social and political attributes, which highlighted that there are also social and political threats and success factors involved in rewilding. However, Segar et al. (2022) only analyzed case examples from Europe, which leaves out key areas where rewilding occurs globally and potentially limits the number of success factors and threats identified through the process.

In this paper, we test the success factors and threats identified by Segar et al. (2022), and IUCN's ten global "Guiding principles" (Table 1) – a suite of ten principles meant to guide rewilding projects towards success (Carver et al., 2021) – against a set of success metrics and threats to rewilding success, as defined by the authors of rewilding reports, that include social, political, and ecological factors. We analyze data from known rewilding case studies against the Guiding Principles for Rewilding, as well as identified sociopolitical success factors and threats, and ask the following research questions:

1. Are there common sociopolitical success factors and threats (Segar et al., 2022) that determine the level of success of a rewilding project?
2. Does implementing each "guiding principle for rewilding" affect the level of success of a project differently?

We predict that:

1. The sociopolitical factors of human-wildlife conflict and mitigation are the primary sociopolitical factors that affect

TABLE 1 Guiding Principles for Rewilding (Carver et al., 2021).

Principle	Definition	Principle Shown in Practice
Principle 1 – Restored food webs	Rewilding uses wildlife to restore food webs and food chains.	Reintroducing a species to create a trophic cascade in an ecosystem, leading to enhanced ecosystem function through regulation of food chain.
Principle 2 - Connectivity	Rewilding plans should identify core rewilded areas, ways to connect them, and ensure outcomes are to the mutual benefit of people and nature.	By connecting isolated areas, wildlife corridors can help to enhance biodiversity and animal populations of rewilded species.
Principle 3 - Recovery	Rewilding focuses on the recovery of ecological processes, interactions and conditions based on similar healthy ecosystems.	Rewilding should aim to restore self-sustaining and resilient ecosystems, using an appropriate ecological reference point.
Principle 4 – Dynamic ecosystems	Rewilding recognizes that ecosystems are dynamic and constantly changing.	Recognizing that temporal cange, but exernal and internal, is a fundamental attribute of ecosystems and the evolutionary processes critical to ecosystem function.
Principle 5 – Climate change	Rewilding should anticipate the effects of climate change and act as a tool to mitigate its impacts.	Rewilding projects have medium- to long-term time scales that span the predicted scales and magnitures of global climate change. It is also considered a nature-based solution (NbS) to climate change.
Principle 6 – Local engagement	Rewilding requires local engagement and community support.	Rewilding should be inclusive of all stakeholders and embrace participatory approaches and transparent local consultation in the planning process for any project.
Principle 7 – Science	Rewilding is informed by science and considers local knowledge.	Traditional ecological knowledge (TEK) provides a complementary body of knowledge to science and collaborations between researchers.
Principle 8 - Adaptability	Rewilding is adaptive and dependent on monitoring and feedback.	Monitoring is essential to provide evidence of short-term and medium-term results with long-term rewilding goals in mind, required to determine whether trajectories are working as planned
Principle 9 – Intrinsic value	Rewilding recognizes the intrinsic value of all species.	Humanity has an ethical responsibility to both respect and protect the value that species and ecosystems have outside of just the goods and services that they provide to humans
Principle 10 – Paradigm shift	Rewilding is a paradigm shift in the coexistence of humans and nature.	Rewilding should create a greater awareness of global ecosystems that are essential to life on the planet, shifting advocacy and activism for change in political will and to help shift ecolofical baselines toward recovering full functioning trophic ecosystems – less overexploitation of nature

the level of success of a rewilding project. (Dickman, 2010; Kaphegyi et al., 2015; Niemiec et al., 2020).

2. A combination of both ecological and sociopolitical guiding principles are important in determining the success of a rewilding project due to their numerous appearances in both peer-reviewed literature and case examples on rewilding (Torres et al. (2018); Segar et al., 2022).

2 Materials and methods

The IUCN Commission for Ecosystem Management (CEM) Rewilding Thematic Group (RTG) drafted a set of ten "Guiding Principles for Rewilding" (Carver et al., 2021) with the aim of improving the effectiveness of rewilding as an intervention to achieve global targets such as the UN Decade on Restoration goals. Here we assess these 10 guiding principles as indicators of success in rewilding projects. We used a global set of case studies from IUCN's "Global Re-introduction Perspectives" (later "Global Conservation Translocation Perspectives"), hereby known as "Global Perspectives" from 2008-2021 (Soorae, 2008; Soorae, 2010; Soorae, 2011; Soorae, 2013; Soorae, 2016; Soorae, 2018; Soorae, 2021) against "Guiding Principles for Rewilding", success factors and threats. While most of the "Global Perspectives" case studies were drafted before the publication of "Guiding Principles for Rewilding", We compared and contrasted the "Global Perspectives" case studies and the "Guiding Principles for Rewilding" against one another to validate the applicability of the principles to a set of global case studies, as they are two IUCN-vetted pieces of literature. We compared each of the 10 Guiding Principles for Rewilding (see Table 1) to the known factors that are associated with success and threats to success (see Table 2) to analyze whether or not the principles were relevant in determining the success of rewilding projects.

2.1 Global perspectives case reports

Of the hundreds of case reports during the span of 13 years, from IUCN's "Global Perspectives", we identified 120 cases that counted as "rewilding" according to IUCN definition from the RTG (Carver et al., 2021), namely that the reintroduction projects that we selected were chosen due to their overall goal of restoring ecosystem function through species reintroduction, rather than a project that was designed solely for the purpose of conserving the species in question. While this may be subjective in nature due to our application of the definition to these projects and its high-level nature, we believe that these case studies do fit the requirements for a rewilding project. We acknowledge that our interpretation of the definition may have excluded certain cases that may include elements of rewilding. All selected case reports were in the categories "reintroduction" or "conservation translocation". We

TABLE 2 Rewilding success factors and threats to success that were identified and used by Segar et al. (2022) in a sample of European rewilding case studies.

Factor	Threat or success	Definitions and activities
Awareness	Success	Rewilding concept appeal
		Strong stakeholder collaboration
		Positive local perception of site
Nature-based economy	Success	Local engagement and pride
		Sustainable funding sources
Proof of concept	Success	Showcasing intermediary results
		Pilot studies demonstrating rewilding potential
Species management	Success	Keystone species reintroduction
		Human-wildlife conflict mitigation
Human-wildlife Conflict (HWC)	Threat	Poaching
		Species persecution
Law and Policy	Threat	Development policies
		Common Agricultural Policies
Land and Water Management	Threat	Hunting
		Over-grazing
		Over-fishing
		Drainage and river regulation
Land-use Change	Threat	Agricultural expansion
		Habitat loss and fragmentation
		Encroaching urbanization
		Road infrastructure
Pollution	Threat	Water pollution
Biotic Pressures	Threat	Invasive species
		Inbreeding depression

only included terrestrial vertebrate species in our analysis, as these species tend to have higher amounts of conflict than terrestrial invertebrates (Torres et al. 2018). Marine environments face unique threats and social and political issues not present in terrestrial environments, and thus are outside of the scope of this paper.

From each case reports we gathered information that describes the social and/or political factors that are related to project success (see Table 2). The success or failure of a project was self-determined by the author of each case report and were assigned the following rating: failure, partially successful, successful, and highly successful (Soorae, 2008; Soorae, 2010; Soorae, 2011; Soorae, 2013; Soorae, 2016; Soorae, 2018; Soorae, 2021). We then tested the association between these four self-assessed ratings of success or failure against the factors and threats that are known to be associated with project success as described by Segar et al. (2022): 1) success indicators; 2) reasons for the level of success; 3) difficulties faced during the project; and 4) project name. Of the six categories of threats to success only two were related to sociopolitical threats and of the nine factors related to success of a project six were sociopolitical in nature (Table 2).

2.2 International Conservation of Nature guiding principles for rewilding

The RTG's principles were developed through a combination of 1) a literature review to establish the drivers behind the evolution of rewilding and inform questions for the rewilding pioneers survey; 2) a rewilding pioneers survey, which included 25 questions relating to historical and current rewilding concepts and practice sent to selected rewilding experts identified through publications in the literature review, published books, and by personal recommendations; and 3) a series of five workshops to solicit expert opinions from more than 100 experts from geographically diverse locations (Carver et al., 2021). The "Guiding principles" are meant to both clarify the concept of rewilding and improve its effectiveness as a tool to achieve global conservation targets, such as the U.N. Decade on Ecosystem Restoration (Carver et al., 2021). As these principles are meant to serve practitioners, meet global goals, and have been created through a comprehensive methodology, we consider them as criteria for success in rewilding projects. To identify which of these principles, when employed, may predict success we analyzed them against the IUCN "Global Perspectives," self-reported levels of success. Of these principles, four relate to social or political themes (see Table 1 for the principles and their definitions).

In this analysis, we first described the species, class, continent, and year of the case report, and then assessing each case report for the presence of each guiding principle. Each success level was coded between "0" and "4", with no data = "0", failure = "1", partially successful = "2", successful = "3", and highly successful = "4". The existence of the principle was coded as a "1" and the non-existence of the principle was coded as a "0" (see Supplemental Online Material (SOM) Table 2 for all coded case studies). Each case study author was asked to assess the level of success of their project, subjectively, based on the success indicators that they chose. All levels of success were pre-determined by the authors of each case study, and therefore the numbers of 0-4 were just allocated during the coding process according to the level of success described by that author. While this may limit the objectivity of the levels of success across all case studies, as each case study chose their own success indicators to measure against, these were the only levels of success available to us to use when assessing each case study.

2.3 Rewilding success factors and threats to rewilding success

Utilizing the same framework as above when assigning codes to case studies, we looked at success factors and threats within the "Guiding Principles", assigning "1" for the existence of a threat or success factor, and a "0" for the non-existence of a threat or success

factor" for any particular case report (see Supplemental Online Material (SOM) Table 2 for a list of all case reports included and the existence or absence of success factors and threats to each case report). We also used rewilding success factors and threats to rewilding success (Table 2) from Segar et al. (2022) to diversify the criteria for determinants of success (Table 2) that are in our analysis, in addition to looking solely at guiding principles as determinants of success. These combined are a new framework for analyzing key success factors of and threats to rewilding globally. Where IUCN's RTG took a global approach to determine overarching principles, Segar et al. (2022) looked specifically at seven European sites to determine success factors and threats to rewilding (Table 2), thus we assessed and expanded Segar et al. (2022) success factors and threats to success globally. While the factors used by Segar et al. (2022) are rooted in specific case studies from Europe, the context of these factors is broad enough that they should be applicable to rewilding projects anywhere in the world. Obviously they would not include any site specific issues (e.g. species or habitat specific), but the Segar et al. (2022) factors remain the best published data and assessment of rewilding, thus are an important component of our analysis.

2.4 Analysis

To address question 1, *what are the sociopolitical factors associated with rewilding success*, we used the list of factors thought to be threats to success and associated with success of rewilding projects as defined by Segar et al. (2022) (Table 2) as the predictor variables. The response variable was the defined level of success of a project. To address question 2, *do the guiding principles affect rewilding success*, the 10 guiding principles were the predictor variables and the defined level of success of a project was the response variable. We coded each case report according to species, class, continent, year, success level, success factors and threats from Segar et al. (2022), as described above, and if they exhibited any of the Guiding Principles for Rewilding (All models are shown in SOM Table 2). Based on the reading of each of the included case reports we determined which Guiding Principles (Table 1) and which factors that are considered threats or associated with success of rewilding projects (Table 2) were associated with each case report.

To address each question we created *a priori* linear regression models, using R version 4.2.2 and the lme4 package to assess the association of guiding principles and/or factors that are thought to be threats or associated with the success of rewilding projects as predictors of the defined levels of success of each case report. We also formulated null models, which assumed no control for taxonomic class, year of the rewilding or continent, for comparison with each of the *a priori* models. All models were formatted as generalized linear mixed models in the Gaussian family with an identity link. *A priori* models had random effects of year, taxonomic class, and continent since different case reports included different case studies of the same species in different continents over different years that produced different success levels. Finally, we combined the different *a priori* models into one global model to compare threats, success factors, and guiding principles against class, continent, and year. Models were ranked based on Kullback- Leibler information (Burnham and Anderson, 2004; Roberts and Luther, 2023).

Support for each model was analyzed with Akaike's Information Criterion corrected for small sample size (AIC_c). We also assessed the model weight (w_i), the distance between the best model and other models (Δ_i), and evidence ratios (w_i/w_j) (Burnham and Anderson, 2002; Roberts and Luther, 2023). A $\Delta_i$between zero to two indicates substantial support for the model, four to seven substantially less support, and models > 10 have essentially no support (Burnham and Anderson, 2002). Therefore, only models with Δ_i between zero and two were considered for parameter estimation. Lastly, models with an evidence ratio of < 0.1 were not considered for further analysis (Burnham and Anderson, 2002).

3 Results

The 120 case reports in this study were from all continents (except Antarctica), and included all terrestrial vertebrate taxonomic groups. Mammals represented over half the cases in the study, followed by birds at almost one fifth of cases, while reptiles and amphibians represented a much smaller portion of the rewilding cases (Figure 1A). The majority of cases were from the global north with fewer cases from regions in the southern hemisphere (Figure 1B).

Mammals had the highest number of projects determined as highly successful projects while birds had the only project that was

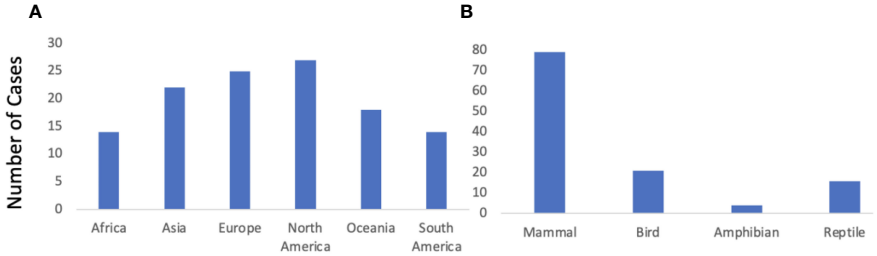

FIGURE 1
The number of case reports included in the study. **(A)** divides the number of cases by global region. **(B)** has the number of case reports by taxonomic group.

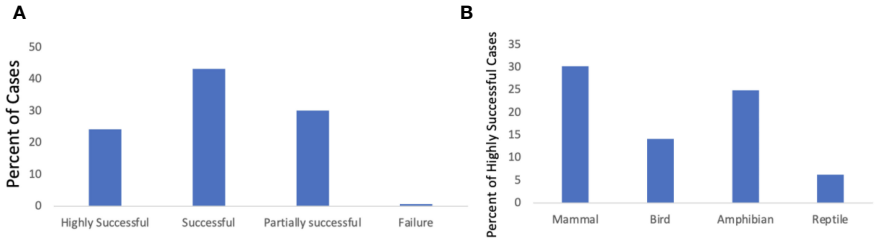

FIGURE 2
(A) The percent of case reports based on the determined success rate of the cases. **(B)** the percent of highly successful case reports for each taxonomic class in the study.

determined to be a failure. Mammals and Amphibians had the highest percentage of projects that were determined to be highly successful (Figure 2A). The greatest proportion of projects were determined to be successful, followed by partially successful, highly successful, and failures (Figure 2B, also see Supplemental Online Material (SOM) Table 2 for list of all case studies, species, threats, and success rates).

3.1 Common sociopolitical factors and threats affecting level of success

The factors that predicted success in most cases were showcasing intermediary results, meaning that a project gives reports of throughout the project, rather than just at the end (by year), pilot studies demonstrating rewilding potential (by year and class) and strong stakeholder collaboration (by year and class) (Table 3; Figure 3), all of which are part of the proof of concept success factor as defined by Segar et al. (2022). Only success factors showed $\Delta_i < 2$, and therefore were the models that predict success in most cases. The parameter estimates for these top models shows high standard error across models (Table 4), meaning that there may not have been a large enough sample size and that these success factors and guiding principles are not as related to success of a project as one might expect given the AIC values.

The top threat was land and water management activities, including hunting, over-grazing, over-fishing, intensive logging, drainage and river regulation (by class and year), but showed a Δ_i of 2.22, which is below the threshold for being one of the factors that predicted success. Based on these results, success factors, more than threats, help determine the level of success of a project.

3.2 "Guiding Principle for rewilding" affecting the level of success

Guiding Principle 9, regardless of the year of the project, class of the rewilded species, and continent on which the rewilding took place, is the Guiding Principle that best predicted rewilding success as none of the other principles were in the top models or had a AIC

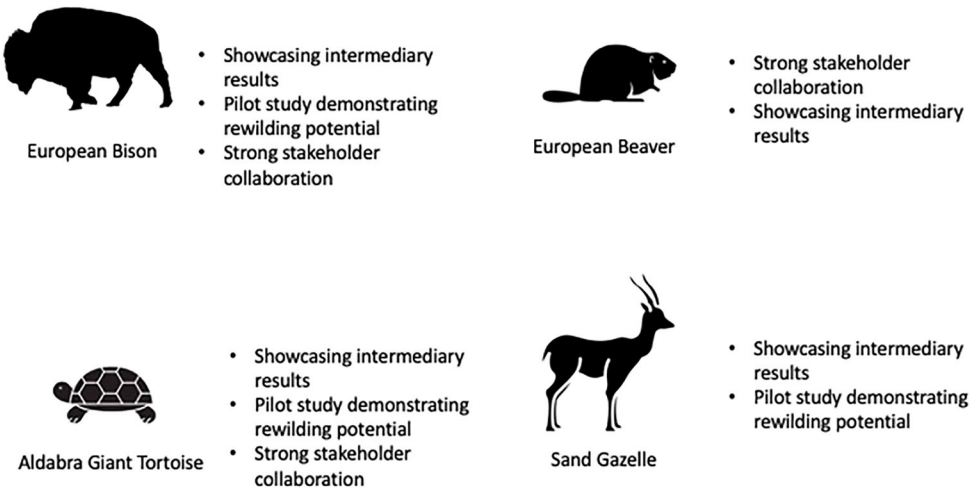

FIGURE 3
Examples of highly successful rewilding projects and their key success factors.

TABLE 3 Top models, with ΔAICc values greater than 2, of sociopolitical factors and threats, from Segar et al. (2022) that are predicted to affect the level of success of rewilding projects.

Model name	*K*	AICc	ΔAICc	w_i
Showcasing intermediary results (by class)	4	300.68	0.00	0.07
Pilot studies demonstrating rewilding potential (by year)	4	301.17	0.49	0.06
Pilot studies demonstrating rewilding potential (by class)	4	301.61	0.93	0.05
Strong stakeholder collaboration (by year)	4	301.96	1.28	0.04
Strong stakeholder collaboration (by class)	4	302.42	1.74	0.03

less than two. Thus, Principle 9, rewilding recognizes the intrinsic value of all species, is the top Guiding Principle for predicting rewilding success (Table 5; Supplemental Online Material (SOM) Table 2 lists all models). Guiding Principles 1, 2, 3, 5 and 10 were within the top 10 models but were separated from Principle 9 by a Null model and all of them had AIC's greater than two, thus were less likely to be associated with rewilding project success (Table 6).

4 Discussion

Our models suggest which threats to success, success factors, and guiding principles for rewilding, are likely associated with the level of success for rewilding, through species reintroduction. Specifically, the success factors of showcasing intermediary results – publicly communicating results throughout a project, not just at the end; demonstrating potential through pilot studies – conducting pilot studies utilizing the same landscape and/or species to demonstrate potential results of a larger project; strong stakeholder collaboration – working with people involved in the project and living alongside it from the beginning; and guiding principle 9 – "rewilding recognizes the intrinsic value of all species", were most strongly associated with a higher level of success of a rewilding project. All three success factors are subcategories of illustrating a proof of concept of rewilding success, which indicates this could be an important aspect of successful rewilding projects and should be considered when planning rewilding programs to help improve the odds of successful rewilding efforts. Our results of the social and political threats, success factors, and guiding principles associated with successful rewilding projects have the potential to help increase the successful outcomes of future rewilding projects.

This project assesses information from rewilding projects around the globe but we acknowledge that it can often be difficult for global analyses to be relevant to specific local projects. Thus, while our study looks at global trends as to which factors are seemingly most important for the success or failure of rewilding projects each local project has unique attributes and situations that might not be relevant under a global lens. Therefore while our findings that: publicly communicating results throughout a project, conducting pilot studies utilizing the same landscape and/or species to demonstrate potential results of a larger project, and working with people involved in the project and living alongside it from the beginning, all should have universal appeal and aid the success of future rewilding projects, they might not be right for all local situations and at the end of the day local knowledge of the ecological, sociological, and political landscape should determine the best course of action for any new rewilding project.

The determination of success in rewilding projects has historically meant biological success of the species being introduced, which usually translates to either survival or breeding success of the rewilded population over a certain period of time, such as 1 year or 5 years. The case studies used for the current study used this same definition of success. However, success of a project can mean many different things to different stakeholders, and having a definition of success that incorporates multiple perspectives at the onset of a project, if agreed upon early in the process, could help ensure that all parties are satisfied with the goals and potential eventual outcome of a project. In the present study, case study authors did not account for success in the eyes of local stakeholders, or anything beyond the original context of the biology of the study organism or ecological impacts from the introduction of that organism. Thus while the case study authors may have deemed their own project a success in biological terms, a local landowner might deem the project unsuccessful because it failed to protect their property or crops or some other resource that was important to them, which needs to be taken into consideration and addressed in future rewilding efforts if we are to garner local landowner participation and buyin to the rewilding process.

4.1 Common sociopolitical factors and threats that determine the level of success of a project

We predicted that the main sociopolitical factors that affected the level of success of a rewilding project revolved around human-

TABLE 4 Parameter estimates for best-supported models that assess success factors and threats.

Model	Estimate	SE
Showcasing Intermediary Results (by class)	0.21	0.27
Pilot Studies Demonstrating Rewilding Potential (by year)	0.18	0.27
Pilot studies demonstrating rewilding potential (by class)	0.31	0.15
Strong Stakeholder Collaboration (by year)	0.37	0.18
Showcasing Intermediary Results (by year)	0.28	0.27

TABLE 5 Top model selection of "Guiding principles for rewilding" that affect the level of rewilding success.

Model name	*K*	AICc	ΔAICc	w_i
Guiding Principle 9 – intrinsic value (by class)	4	301.23	0.00	0.16
Guiding Principle 9 -intrinsic value (by year)	4	301.80	0.56	0.12
Guiding Principle 9 -intrinsic value (by continent)	4	303.00	1.76	0.07
Null model Guiding Principle 9 (by year)	3	303.04	1.81	0.07

wildlife conflict and mitigation. However, we found instead that while this success factor and threat to success may be included in activities that fall under one of the named factors, human-wildlife conflict and mitigation were not explicitly the most related to the success or failure of a project. Furthermore, we found that the success factors of showcasing intermediary results, pilot studies demonstrating rewilding potential, and strong stakeholder collaboration were statistically significant to the level of success of a rewilding project. Threats were not included as important factors to consider as they did not have a ΔAICc of less than two, making them less likely to influence success than the key success factors and guiding principles.

These factors can be seen in multiple case studies from the "Global Perspectives" across the years 2008-2021, in particular cases about the sand gazelle (Soorae, 2008), Eurasian beaver (Soorae, 2011), Aldabra giant tortoise (Soorae, 2018), and European bison (Soorae, 2021) that were all reported as "highly successful" rewilding projects. The sand gazelle case used post-release monitoring after successive years of reintroduction, and modified each release method based on the results of the previous year of monitoring, each of which had a successful number of living and breeding individuals during the monitoring (Soorae, 2008) – the ability to demonstrate intermediary results and pilot studies demonstrating rewilding potential. The Eurasian beaver example also included post-release monitoring over decades to provide examples of success and evaluate what they might do better in future releases, but also worked with local hunters before the project started to make sure they would follow hunting regulations (Soorae, 2011) – indicating strong stakeholder collaboration and showcasing intermediary results.

The Aldabra giant tortoise example, one of the few reptile examples included in the "Global Perspectives", was also "highly successful" and included all three success factors. The species itself was chosen as an ecological replacement because they could be easily removed if they were shown to have deleterious impacts, scientists employed continuous research and monitoring since release, and they collaborated between the private sector, universities, and the Mauritian Wildlife Foundation (Soorae, 2018). Finally, the European bison also exhibited all three success factors, making it a "highly successful" project. This project conducted post-release monitoring, engaged in educational and public awareness activities, established mechanisms to provide benefits to the local economy, provided evidence of high post-release survival and birth numbers across multiple releases with no cases of poaching, and this project was replicated in other sites in Romania as a result (Soorae, 2021). All of these examples show that "highly successful" rewilding projects employ intermediate results based on post release monitoring as an important factor of successful rewilding.

TABLE 6 Parameter estimates for best-supported models that assess the "Guiding principles for rewilding" that affect the level of rewilding success.

Model	Estimate	SE
Guiding Principle 9 – intrinsic value (by class)	-0.38	0.18
Guiding Principle 9 – Intrinsic value (by year)	-0.37	0.19
Guiding Principle 9 – intrinsic value (by continent)	-0.43	0.18
Null model Guiding Principle 9 (by year)	2.89	0.12

Human-wildlife conflict and mitigation can fall under the categories of strong stakeholder collaboration (mitigation) and land and water management (Segar et al., 2022), as conflict requires stakeholders to work together to solve problems and conflict can also arise due to different land and water management practices that can affect where a species goes versus does not. Human-wildlife conflict has been shown to be present in many rewilding projects that involve reintroductions (Ramos et al., 2018; Jordan et al., 2020; Thulin and Röcklinsberg, 2020; Banasiak et al., 2021). These results do not necessarily mean that human-wildlife conflict and mitigation are not related to the level of success of a project, but rather that they are a subset of an entire suite of success factors and threats that determine the level of success of a project. Segar et al. (2022) found that the highest number of rewiding sites employed "rewilding concept appeal", "local engagement and pride", "showcasing intermediary results", and "keystone species reintroduction" as the main key success factors within the projects studied. This is slightly different than the best models we found, which included "showcasing intermediary results", "pilot studies demonstrating rewilding potential", and "strong stakeholder collaboration". Differences in results could be due to the fact that the case reports that we examined had a global lens, rather than strictly European. There may be differences in the success of rewilding projects in different parts of the world that would lead to different success factors being more or less important to the success of the project. Additionally we included a broader taxonomic group of species which might have affected the different results between Segar et al. (2022) and this study.

4.2 Guiding principles for rewilding that affect the level of success of a project

Only one of the guiding principles guiding principle 9, "Rewilding recognizes the intrinsic value of all species" correlated with level of success. We expected that other guiding principles would potentially be significant as they often appear in the literature and case studies (Bavin et al., 2020; Coz and Young, 2020; Drouilly and O'Riain, 2021; Thomas, 2022). While principle 9 is difficult to measure quantitatively it was not difficult to pull text about this principle out of the case reports to be included in our analyses.

Rewilding aims to restore ecosystems by allowing natural processes and wildlife to reclaim areas no longer under human management, or under minimal management, and therefore ethical considerations must be taken into account when taking on a rewilding project. Guiding Principle 9 demonstrates the importance of providing nature with its own intrinsic value, meaning humanity has the ethical responsibility to protect and respect it (Carver et al., 2021). Rewilding also poses other ethical considerations related to intrinsive value, including the welfare of animals set to be reintroduced or translocated, and as ethical values clash that can happen when moving a potentially problematic animal from one place to another (Thulin and Röcklinsberg, 2020). Finally, Guiding Principle 9 emphasizes the values of compassion and coexistence within rewilding projects, something that marks rewilding as different than a pure reintroduction or translocation (Carver et al., 2021). The focus is ecocentric, rather than anthropocentric. However, while intrinsic value is shown to be important in the success of rewilding projects, as well as a value that underpins norms in the field of conservation biology, it is not uniformly accepted in broader society. This is why it is critical to look at how principle 9 is practiced in the field and whether its existence can be assessed through stakeholder engagement.

When looking at measuring principle 9 in practice, rewilding practitioners should be focusing on the affected stakeholders' perceptions of the project itself, as well as any wildlife involved. Measuring intrinsic value here means that stakeholders see value in the wildlife outside of just the economic benefits, and goods and services, that they may provide to people (Vucetich et al., 2015; Carver et al., 2021). This could take the form of workshops, learning whether stakeholders believe that nature and any specific species involved have intrinsic value, or questionnaires to assess the values that are held by stakeholders regarding nature in general and the project specifically. Understanding the underlying values and attitudes that stakeholders have towards a project and nature, demonstrated through evaluating the existence of principle 9, are critical to knowing whether success is possible given current perceptions (Teel and Manfredo, 2010; Bennett et al., 2017; Manfredo et al., 2021). When examining the rewilding of small-bodied species like river otters and birds, it is necessary that the public recognize the intrinsic value of the species and the desire to coexist with them (Sakurai et al., 2022). Once agencies and practitioners understand whether an affected group of stakeholders believes in the intrinsic value of nature, they can work on trying to change perceptions if necessary. Thus, recognizing the intrinsic value of all species is key to rewilding success, and should be considered in future rewilding projects as a main piece to establish before a project begins. Our results show that when this principle is considered in a project, the likelihood of success increases, demonstrating the importance of incorporating social science into rewilding practice.

The ten "Guiding Principles for Rewilding" (Carver et al., 2021) were created to clarify the concept of rewilding, which can be at times be vague and all-encompassing. In comparison to the Society for Ecological Restoration principles for restoration and the European Rewilding Networks' "Global Charter for Rewilding Principles", the "Guiding Principles for Rewilding" include more social and political factors (Jepson, 2022). Narrowing down the concept to ten well-defined principles is aimed to help practitioners looking to begin rewilding projects and who are struggling with where to begin and what to include in their preliminary assessments.

While the results of our study should make an important contribution to future rewilding efforts it is important to note that the "Global Perspectives" case reports had a very low reported number of cases as "failure" – only one across 120 case studies – showing that the subjectivity of the authors' self-reports may have affected what contributes to "success" in a project. In fact, many reintroduction and translocation projects fail as translocated populations often do not survive past the first year due to inadequate space, conflict, small sample size, and acclimation to captivity, among other reasons (Bennett et al., 2012; Germano et al., 2015; Ovenden et al., 2019). In the future this propensity for failure among rewilding projects, through species reintroduction, should be taken into account when looking at self-reported successes.

4.3 Further study

The results highlight the importance of a proof of concept and local awareness of rewilding prior to implementation as critically important factors that aid in the success of rewilding projects. In addition, the activities laid out in the success factors are clear: demonstrate that a pilot study has rewilding potential, showcase that a project is having positive intermediary results, and involve stakeholders in collaborative ways throughout a project – all of these factors are sociopolitical in nature. If going into a project with these activities in place, and thinking about rewilding itself as an activity that affords wildlife and nature intrinsic value, a project is more likely succeed. Therefore, in order to improve upon the success of rewilding projects, these sociopolitical factors should be taken into account by practitioners, at least where rewilding through reintroduction is the method of choice. However, there are potential limitations to using this case report data in evaluating success factors, threats and the guiding principles due to the authors' self-assessment of success within each report. There were no specific criteria that each author had to vet their project against when determining success, and therefore each author selected the

level of success subjectively. In order to make this a more quantitatively robust study, it would be of value to have case studies of rewilding that each evaluate success based on a set of pre-defined criteria, and to look at success factors, threats, and guiding principles involved in those case studies.

While IUCN's "Guiding principles for rewilding" (Carver et al., 2021) are helpful in determining what underlying principles a rewilding project should embody, there is clear need for more practical guidance in how to properly conduct a rewilding project from both the ecological and social perspectives. Following IUCN's "Guidelines for reintroductions and other translocations" (IUCN SSC, 2013), as well as "Guidelines to facilitate human-wildlife interactions in conservation translocations" (Consorte-McCrea et al., 2022) are important to set the stage for conservation translocations and reintroductions on the whole, there is a need for practical guidance on conducting rewilding projects that does not currently exist. We suggest the creation of a set of practical guidance on rewilding that takes into account both ecological and sociopolitical factors for success, and ensures that the guiding principles for rewilding are embodied in a project from the outset. This type of guidance would set rewilding projects up for success.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

SW: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. DL: Methodology, Resources, Writing – original draft, Writing review & editing, Visualization. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcosc.2023.1205380/full#supplementary-material

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