wildE

Climate-smart rewilding for Europe

Minimal interventions to increase landscape resilience to climate change disturbances under rewilding

Deliverable 2.2

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Summary

Rationale

This document provides an overview of the activities carried out and the main results obtained under Task 2.2, “Rewilding adaptability under increasing climate change disturbances”, within Work Package 2, “Rewilding Practice: In-depth analysis of rewilding contexts, practices and outcomes”, of the wildE project; a project aimed to evaluate and strengthen the role of climate-smart rewilding as a nature-based approach to ecosystem restoration across Europe.

To contribute to the overarching goal of the wildE project, Task 2.2 was designed to examine the nexus between rewilding and disturbances: that is, the extent to which rewilding actions may increase ecosystem resilience to disturbances driven by climate change, and whether these restoration practices may, under some circumstances, contribute to the occurrence of disturbance events, with particular attention given to wildfires. The ultimate aim of this task was to identify those interventions that can enhance the adaptability of rewilding projects to increasing climate change-related disturbances.

Our objectives were addressed through the following activities:

1. A literature review on the nexus between rewilding and disturbance, with particular emphasis on developing a framework for restoring fire regimes through rewilding.
2. A vote-counting and meta-analysis exercise to examine the extent to which rewilding interventions increase ecosystem resilience or may facilitate the occurrence of disturbances in terrestrial ecosystems.
3. A workshop on “Rewilding in the context of increasing climate change disturbances” to gather feedback from the different case studies included in wildE and refine the results of the literature review, particularly regarding the rewilding and wildfires nexus.

Main Results

The literature review and vote-counting/meta-analysis of 305 observations from 42 case studies revealed that, overall, the rewilding restoration approach increased ecosystem resilience (70% of observations), particularly for those variables related to demography, biodiversity, biophysical characteristics and the disturbance regime. Yet, these results were influenced by the nature of the disturbance and the resilience approach; with lower success reported for abiotic disturbances (drought and fire) and social-ecological resilience. While interventions targeting only disturbance stochasticity or biodiversity and disturbance stochasticity together showed positive effects on most system variables related to biodiversity, interventions targeting the trophic

complexity alone contributed less. The most common rewilding interventions, such as domestic and wild herbivore introductions and invasive plant removals, were the most effective on increasing resilience towards biotic disturbances (i.e., invasions).

Notwithstanding the overall positive effects of rewilding for ecosystem resilience, the literature review of 110 studies and the specific workshop also informed about potential risks of this restoration practice on increasing disturbances. These potential risks were mostly associated with two of the core processes underlying rewilding – the increase of connectivity and of disturbance stochasticity - while effects reported for increasing trophic complexity were mostly positive. Additionally, the reduction of human intervention, particularly associated with passive rewilding (e.g., farmland abandonment), was also pinpointed as a potential risk driving "maladaptation" to future climate change scenarios or resulting in excessive connectivity and biomass accumulation leading to more severe wildfires, the spread of pests and diseases, and the loss of biodiversity associated to open spaces. From a social perspective, passive rewilding could also result in land-use conflicts and the loss of cultural landscapes. Interventions recommended to reduce these risks included preserving "functional" herbivory by maintaining suitable densities of wild or domestic grazers, thereby limiting fuel build-up and supporting biodiversity in open habitats. These measures could be combined with prescribed burning or targeted fuel management to lower wildfire risk, while reintroducing disturbance regimes in a controlled way. Results further highlighted the importance of moving away from fixed historical restoration benchmarks and adopting more forward-looking strategies that consider future climatic conditions (e.g., increasing drought). These strategies and interventions may include promoting mixtures of climate-adapted species, sustaining ecological connectivity to enable species migration, and protecting climate refugia. Moreover, long-term monitoring and adaptive management frameworks were also considered necessary to ensure the success of rewilding projects. In this sense, our results suggest that rewilding should not be considered as a hands-off objective in itself, but as a process that requires careful monitoring and limited adaptive interventions when climate-driven disturbances exceed the capacity of landscapes to self-regulate.

As for the restoration of wildfire regimes through rewilding, the framework developed also stresses the need to move beyond passive non-intervention approaches and adopt adaptive, process-based management strategies. Trophic interactions, dispersal processes, and disturbance dynamics strongly influence fuel accumulation, vegetation structure, biodiversity, and wildfire behavior across landscapes. Therefore, rewilding interventions such as restoring functional herbivory, reintroducing ecosystem engineers, and promoting heterogeneous vegetation mosaics were considered as the more effective steps to reduce wildfire severity and enhance ecosystem resilience. In addition, adaptive fire management and controlled disturbance regimes were also considered essential interventions to restore "pyrodiversity" and ecological functioning. Importantly, restoration strategies should account for future climatic conditions and socio-ecological contexts rather than relying solely on historical baselines. Therefore, the framework developed further highlights the importance of flexible management, and stakeholder participation actions to balance biodiversity conservation, ecosystem functioning, and wildfire risk reduction.

Overall, our results highlight predominantly positive effects of rewilding on ecosystem resilience, underpinning the potential of this approach to prepare ecosystems for the uncertain effects of accelerating climate change and associated disturbances, yet acknowledging some context-dependent limitations associated with the nature of the disturbance (lower for severe abiotic agents), and the potential threats arising from interactions among different disturbances, increased landscape connectivity and reduced human intervention. To overcome these limitations and ensure the adaptability of rewilding projects, several interventions may be carried out in an active rewilding scheme. Yet, the intervention logic emerging from the results is deliberately minimal: act only where rewilding trajectories may increase vulnerability to future disturbances, and prioritize measures that reinforce natural regulation rather than replace it.

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1. Introduction

The world is facing an accelerating dual crisis driven by climate change and biodiversity loss, two closely interconnected processes that reinforce one another (O'Connor et al., 2020). Increasing frequency and intensity of disturbance events — including floods, heatwaves, wildfires, and droughts — as well as ongoing habitat degradation and destruction, highlight the urgent need for actions aimed at restoring ecosystems while strengthening their resilience to future environmental changes. In this context, rewilding has emerged as a promising restoration approach aimed at promoting self-sustaining ecosystems by recovering natural ecological processes, including trophic complexity, natural disturbance dynamics, and ecological connectivity, while reducing human intervention (Perino et al., 2019; Svenning, 2020); with the ultimate goal of increasing both biodiversity conservation and ecosystem resilience.

Yet, although rewilding is widely recognized for its positive effects on biodiversity conservation, its contribution to ecosystem resilience under climate change remains insufficiently understood (Carroll and Noss, 2021). Existing evidence is still fragmented on how rewilding interventions may influence the capacity of ecosystems to resist, recover from, and adapt to increasing disturbances. Additionally, there is also the need for knowledge on whether some rewilding actions may increase disturbance risks and to evaluate which interventions may be necessary to reduce these effects and ensure the adaptation of rewilding landscapes to the most relevant disturbances associated with climate change. This evidence gap is central to the title of the deliverable, because deciding when intervention should occur depends on understanding which rewilding trajectories enhance resilience and which others may amplify climate-related disturbance risks.

Among natural disturbances, fire represents a fundamental ecological process across many ecosystems, influencing species composition, ecological interactions, habitat heterogeneity, and long-term ecosystem functioning (Bond and Keeley, 2005). Many ecosystems and species have evolved under specific fire regimes, developing ecological adaptations that depend on recurrent fire events for regeneration, dispersal, or maintenance of biodiversity (He et al., 2019). However, recent anthropogenic changes — including climate change, fire suppression, land abandonment, plantation forestry, urbanization, and altered grazing regimes — have profoundly transformed fire frequency, severity, seasonality, and spatial patterns (Bowman et al., 2020; Stephens et al., 2024). Ultimately, in many fire-prone systems, these changes have increased fuel accumulation and landscape homogeneity, favoring larger and more severe wildfires, whereas in fire-sensitive ecosystems the introduction and spread of anthropogenic wildfires is starting to result in ecosystem degradation and shifts towards alternative ecological states.

In light of these increasing threats, there is the need to develop a conceptual framework specifically addressing wildfire-regime restoration within rewilding practices. Indeed, fire regimes are intrinsically linked to two key processes in rewilding, i.e. trophic interactions and dispersal processes, creating complex feedbacks that influence biodiversity, ecosystem resilience, and landscape dynamics (Perino et al., 2019; Svenning, 2020).

Consequently, restoring fire regimes in a rapidly changing world cannot rely solely on passive management or historical references, but it will require adaptive and context-dependent strategies capable of integrating ecological processes, climate change, and socio-ecological realities. Rewilding offers a potential framework for restoring ecologically functional fire regimes through actions such as targeted herbivory, reintroduction of ecosystem engineers, adaptive ignition management, and modified suppression practices. Ultimately, understanding how fire interacts with trophic complexity, dispersal, and human activities is essential for developing restoration pathways capable of enhancing biodiversity, ecosystem functioning, and resilience in an increasingly disturbance-prone biosphere.

Against this background, this deliverable aims to examine and inform on:

i) to what extent the ecological processes at the core of rewilding (i.e. trophic complexity, ecological connectivity and stochastic disturbances) may increase resilience to climate change driven disturbances,
ii) to what extent rewilding actions may increase the risk of climate change driven disturbances and which intervention actions may be required to ensure the adaptation of rewilding landscapes and,
iii) focusing on wildfires, as one of the main potential threats associated to climate change, provide a framework including the most relevant interventions for restoring fire regimes through rewilding

These objectives were addressed by means of a thorough literature review, the use of “vote counting” and meta-analysis techniques, and the discussion of their outcomes during a specific workshop jointly organized with other EU and national projects targeting the potential of rewilding as a restoration practice (respectively, WILDCARD and REWILDFIRE).

2. Material and Methods

2.1 Addressing the rewilding and disturbance nexus

2.1.1. Developing a unifying framework to assess resilience in rewilding projects

To assess the potential of rewilding to increase ecosystem resilience to climate change driven disturbances, we developed a framework including the three main rewilding components described in the literature — i.e. trophic complexity, stochastic disturbances, and connectivity (see Perino et al. 2019) — as “resilience predictors” within the operational resilience framework (ORF) developed by Lloret et al. (2024). Thus following the ORF rationale, rewilding interventions are considered manageable actions capable of influencing ecosystem resilience by their effects on demographic processes, biodiversity patterns, biophysical characteristics, and disturbances regulation under changing environmental conditions (Figure 1; see Selwyn et al. 2025 for further information on this rationale).

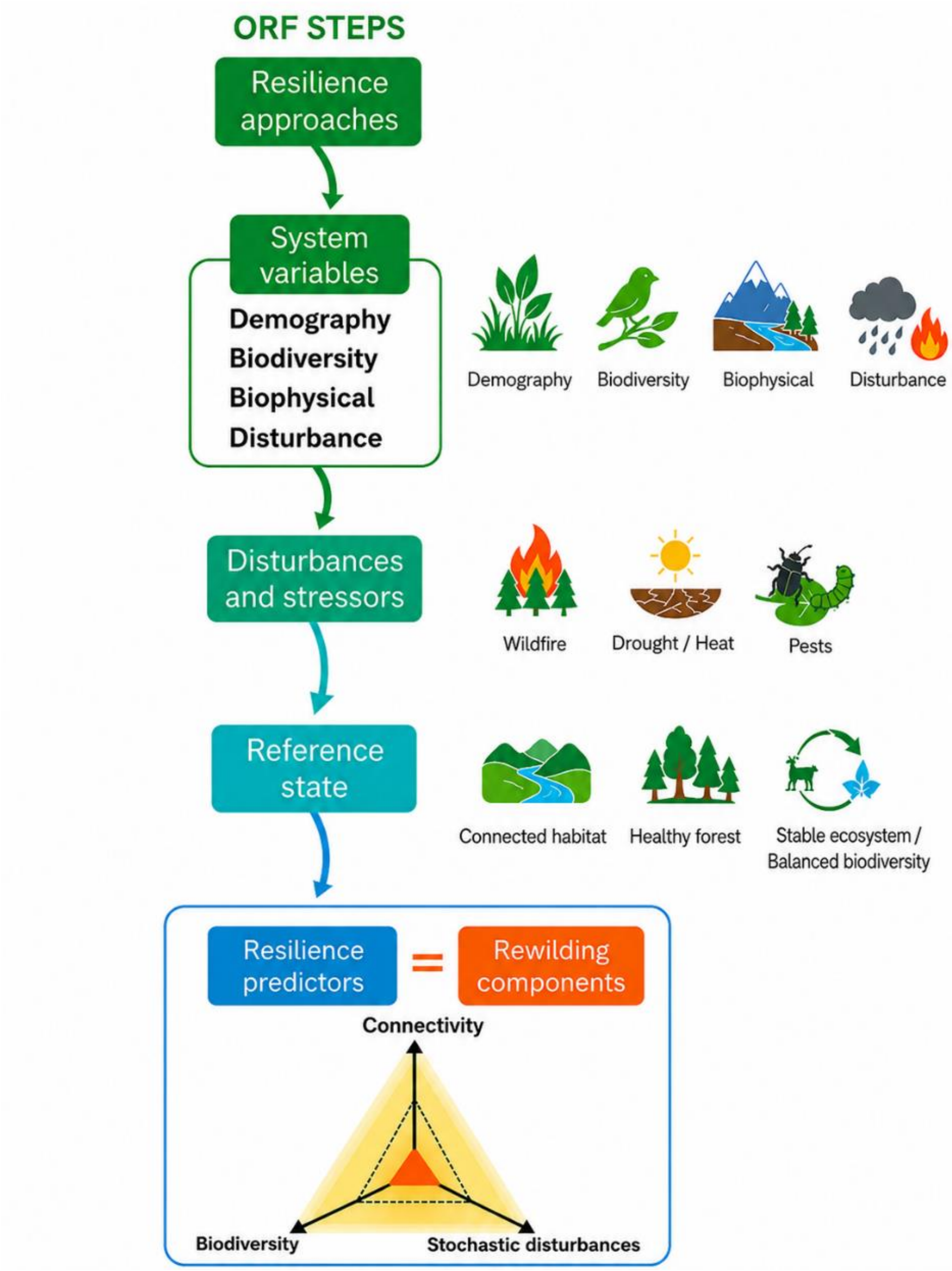


Figure 1. Representation of the coupling and unification of the two frameworks of Lloret et al. (2024) addressing resilience and Perino et al. (2019) addressing rewilding. The Operational Resilience Framework (ORF) steps shown are a simplified version of the roadmap to assess resilience in Lloret et al. (2024). The final step links the resilience predictors (i.e., manageable variables influencing resilience) with the three rewilding components (biodiversity or trophic complexity, stochastic disturbances, and connectivity) of rewilding interventions, able to promote self-regulating ecosystems as defined by Perino et al. (2019). Modified from Selwyn et al. (2025).

2.1.2 Literature review: Data acquisition and data extraction

The literature review was conducted following the practical guidelines for systematic reviews in ecology and evolution proposed by Foo et al. (2021). To structure the selection of studies, the PICO framework described by Richardson et al. (1995) was applied, considering: (i) rewilding interventions targeting biodiversity (trophic complexity), disturbance stochasticity, connectivity, or combinations of these components; (ii) ecosystems exposed to passive or active rewilding and subsequently affected by a disturbance; (iii) non-rewilded control areas exposed to the same disturbance; and (iv) comparisons of system variables between rewilded and non-rewilded conditions relative to a reference state. The literature search was carried out using the Web of Science® database without restrictions on publication year. Search terms combined concepts related to “rewilding” or “restoration”, “disturbance”, and “resilience”, while excluding aquatic systems (see Selwyn et al. 2025 for further details). The term “restoration” was additionally included to capture studies aligned with rewilding principles but not explicitly using the term “rewilding”. The search initially identified 879 articles, which were subsequently screened according to the predefined criteria. Studies lacking appropriate controls or explicit resilience assessments were excluded. For the study on the effects of rewilding on resilience this resulted in a final dataset of 42 studies (Annex 1) including 305 different variables (“observations” in the vote counting and meta-analysis jargon), while for the analysis of rewilding actions on increasing disturbances (YES, NO, NEUTRAL) and the potential interventions to mitigate these effects, it included a final dataset of 110 articles (Annex 2).

For each selected study, information was extracted regarding: (i) general study characteristics (e.g., coordinates, ecosystem type, time since treatment), (ii) rewilding interventions and targeted rewilding components, (iii) disturbance characteristics, and (iv) resilience-related variables and approaches (Table 1). To assess resilience outcomes after disturbance events, means, variances, and sample sizes of system variables were recorded for both rewilded and non-rewilded conditions, considering either pre-disturbance values or an equivalent desired reference state. When studies reported repeated measurements over time, only the latest observation was retained to capture more stable rewilding effects.

Owing to the large number of different system variables recorded in the primary studies, they were classified into four broader types of categories, namely, (i) individual characteristics and demographic processes, (ii) compositional, trophic, and functional biodiversity, (iii) biophysical characteristics and structure and (iv) characteristics of the disturbance regime (Table 2).

Table 1. Complete list of variables extracted from the primary studies selected. Modified from Selwyn et al. (2025)

<u>**General article characteristics**</u>
DOI: reference information for each study.
Publication year: the year of publication.
Study design: methodological approach for each study categorized into experimental, observational, satellite data or simulation.
Country: geographical location of the study.
Coordinates: geographical position of each study site (x and y coordinates).
Biome: As biome information was not standardized across papers, we classified the study cases for climate based on the geographic position of the study site using the global Köppen-Geiger climate classification map (http://koeppen-geiger.vu-wien.ac.at/present.htm). This resulted in temperate forests, mediterranean woodlands, temperate and subtropical grasslands/savannas, tropical/subtropical forests, and boreal/montane forests
Ecosystem type: categorized into forest or grassland ecosystems as reported in the primary studies.
Spatial scale: area undergone rewilding treatment: site (10-1000m2), local (1-10km2), landscape (10-200km2), regional (200-2000km2), and global (> 10000km2).
Temporal scale: time since rewilding treatment measured in years.
<u>**Rewilding data**</u>
Previous degradation: past land use or disturbance for each study site (i.e., agriculture practices, livestock overgrazing, mining, fire, presence of invasive species) for which rewilding passively or actively occurred.
Rewilding type: categorized into passive (e.g., allowing natural succession after land abandonment or after disturbances) or active (see Rewilding interventions below).
Rewilding components: consisted of the three rewilding components proposed by Perino et al. (2019) (i.e., trophic complexity, disturbance stochasticity and dispersal) to promote self-regulating complex ecosystems by restoring non-human ecological processes while reducing human control and pressures.
Rewilding interventions: specific rewilding interventions reported for each study. Rewilding interventions were further categorized into three rewilding components (biodiversity, disturbances, connectivity) similar to the those described by Perino et al. (2019), namely, trophic complexity, disturbance stochasticity and dispersal. Thus, we considered a rewilding intervention to target trophic complexity when the outcome increased compositional or functional complexity (e.g., increase in biodiversity). We considered a rewilding intervention to target stochastic disturbance when the outcome released ecosystems from continued and controlled anthropogenic disturbances (e.g., restoration of semi(natural) fire regimes). We considered a rewilding intervention to target dispersal when the outcome improved connectivity among habitats allowing for dispersal of species (e.g., reduce landscape fragmentation).

- **Specific rewilding interventions which targeted trophic complexity** were animal introduction, animal removal, herbivory enclosure, invasive or non-native plant removal, plant introductions, animal protection, and plant protection.
- **Specific rewilding interventions which targeted disturbance stochasticity** were the use of prescribed fire or grazing.
- **Specific rewilding interventions which targeted trophic complexity/disturbance stochasticity** were any of the above trophic complexity and disturbance stochasticity interventions combined.
- **Specific rewilding interventions which targeted trophic complexity/dispersal** were animal introduction and animal removal.

Specific species managed: categorization of the species managed into: (i) wild, domestic, or invasive animals and their ecological guild (i.e., carnivores, herbivores, omnivores), and (ii) native or invasive plants and plantation forests, and their life forms (i.e., trees, shrubs, herbs).
<u>**Disturbance data**</u>
Specific disturbance: specific disturbances reported for each case study. Abiotic disturbances included drought and fire, biotic disturbances included intense herbivory, pests and invasive species.

Disturbance agent: specific disturbances categorized whether disturbances were generated by abiotic, or nonliving, forces such as weather and wildfires, or as a result of biotic, or living, forces such as invasions of exotic species and pests.
Disturbance type: as disturbance can vary in their frequency and intensity, we generally categorized them as reported in the primary studies, as**:**

- Episodic disturbances: infrequent but often intense events that cause significant changes in the ecosystems assessed.

- Gradual disturbances: disturbances that occur slowly over extended periods.

- Recurrent disturbances: regular and sometimes predictable events that occur at relatively consistent intervals.

Resilience data:

Resilience approach:

- **Engineering resilience:** recovery of a system to its previous undisturbed state (reference state) (Pimm, 1984) as stated in the primary studies.
- **Ecological resilience:** maximum change that a system can absorb without shifting to an alternative state (Holling, 1973) as stated in the primary studies.
- **Socio-ecological resilience:** capacity of a socio-ecological system to reorganize, adapt and provide ecosystem services after disturbance (Folke, 2006) as stated in the primary studies.

Resilience dimension: resistance, recovery, and resilience concepts were used to describe how each study system responded to the disturbance event (see Lloret et al., 2024; Van Meerbeek et al., 2019), as reported in the primary studies.

- **Resistance:** the ability of the system to withstand disturbances without undergoing significant changes in its structure and function.
- **Recovery:** the ability of the system to return to its pre-disturbance state following disturbance. It involves the re-establishment of species, community structure, and ecosystem functions.
- **Resilience:** the capacity of a system to absorb disturbances, reorganize, and continue to function in a similar way. It encompasses both resistance to change and the ability to recover after disturbances.

System variable: system variables correspond to the measured variables reported in each primary study, for which resilience is quantified. As described in the ORF (Lloret et al. 2024), resilience of a system is estimated by comparing the state of these system variables modified by disturbances or stressors in comparison to values (i.e., reference state) that correspond to the absence of disturbance or stress, or, alternatively, to situations in which the variables remain within acceptable thresholds. The closer the variables of the system affected by disturbances or stressors get to these reference values, the greater is the resilience.

Table 2. Classification of the system variables (response variables) extracted from the primary studies into four main categories (colored differently). The most frequent measurement units and the number of observations and primary studies for each category are shown. Modified from Selwyn et al. 2025

System variable category	System variable	Metric	(Number of observations, Number of primary studies)
Individual characteristics and demographic processes (Demography)	Animal abundance, animal density, animal visits, density of dead trees, dispersed seeds, drought tolerance, fruit	Individuals·ha^{-1}, count, %, cm^2·year^{-1}, kg·ha^{-1}, µmol^{-1}·FW, cm.	(114,36)

System variable category	System variable	Metric	(Number of observations, Number of primary studies)
	removal, number of flowers, number of seeds, plant abundance, plant density, seedling recruitment, survival, tree growth, tree recruitment		
Compositional, trophic, and functional biodiversity (Biodiversity)	Plant diversity, animal diversity, plant-animal interactions, species turnover, functional redundancy	Richness, Shannon index, evenness, %, counts.	(34,15)
Biophysical characteristics and structure (Biophysical)	Basal area, canopy height, carbon storage, vegetation cover, litter cover, area lost, bare soil, microbial biomass, NDVI, plant biomass, soil features, water content	$m^2 \cdot ha^{-1}$, m, %, $kg \cdot ha^{-1}$, μmol $CO_2 \cdot m^{-1} \cdot s^{-1}$, mg $C \cdot g^{-1}$, $g \cdot g^{-1}$.	(81,32)
Disturbance characteristics (Disturbance)	Browsing, fire likelihood, fuel load, invasive plant features (biomass, abundance, basal area, growth, cover, diversity, number of flowers, number of fruits, density, seedling recruitment, survival)	cm, cm^2, count, %, $individuals \cdot ha^{-1}$, $kg \cdot ha^{-1}$, $m^2 \cdot ha^{-1}$, m, richness, g/m^2.	76,40

2.1.3. Data analysis

The effects of rewilding on ecosystem resilience were assessed through complementary qualitative and quantitative analyses. First, a vote-counting approach based on the direction of effects was applied following Light and Smith (2012). Rewilding interventions were classified as having positive, negative, or neutral effects on resilience depending on whether the primary studies reported statistically significant increases, decreases, or non-significant changes in resilience-related variables compared with non-rewilded controls. Chi-squared tests were subsequently used to evaluate whether the observed frequencies of positive, neutral, and negative effects differed from random expectations. In parallel, a quantitative meta-analysis was conducted to estimate the magnitude and direction of rewilding effects on ecosystem resilience. Effect sizes were calculated using Hedges' g based on means, variances, and sample sizes extracted from rewilded and non-rewilded conditions. Mixed-effects meta-analytical models were fitted including study identity as a random effect to account for the non-independence of multiple observations within the same study. The analyses evaluated: (i) the overall effect of rewilding on resilience, (ii) the influence of moderators such as system variable category, resilience approach, disturbance type, and ecosystem type, (iii) the individual contribution of each rewilding component, and (iv) the effects of the most common biodiversity-focused interventions, including animal introductions and removals, and plant introductions and removals. Model selection was based on the Akaike Information, heterogeneity among observations was assessed using the QM and I^2 statistics, while Rosenthal's fail-safe number was calculated to evaluate the robustness of the results (see Selwyn et al. 2025 for further details on these analyses).

To analyze the potential effects of rewilding on increasing disturbances (YES, NO, NEUTRAL) we also used the already presented vote-counting approach based on the direction of effects (Light and Smith 2012). Rewilding interventions were classified as having positive, negative, or neutral effects on the occurrence of disturbances on whether the primary studies reported statistically significant increases, decreases, or non-significant changes, while the nature of the disturbance events and the interventions suggested to mitigate their effects were also retained. Chi-squared tests were subsequently used to evaluate whether the observed frequencies of positive, neutral, and negative effects differed from random expectations. This classification was essential for distinguishing later cases in which non-intervention may be sufficient from those where minimal corrective actions are needed to avoid maladaptive disturbance dynamics.

2.2 Restoring fire regimes through rewilding

As illustrated by the results gathered in the previous section, the rewilding–wildfire nexus was among the most challenging questions surrounding the application of rewilding. To address this issue, we examined how rewilding could contribute to restoring an ecologically functional fire regime, using a conceptual and integrative literature review approach. Rather than applying a quantitative meta-analysis such as the one applied for the analysis of the rewilding and resilience nexus, we synthetized knowledge from fire ecology, restoration ecology, rewilding theory, and socio-ecological systems to develop a conceptual framework linking fire regimes with the key ecological processes at the basis of rewilding (Plumanns-Pouton et al. 2025).

This approach was structured around several complementary analytical steps. First, we reviewed how anthropogenic pressures such as climate change, land abandonment, fire suppression, forestry plantations, grazing changes, urbanization, and species introductions have altered the main components of fire regimes globally. This analysis was organized around the concept of “fire switches”, including fuel availability, fuel dryness, ignition sources, fire weather, and suppression dynamics, which together determine fire frequency, severity, intensity, and spatial arrangement. Second, we examined the interactions between fire and two out of the three core ecological dimensions of rewilding, i.e.: trophic complexity and dispersal. Through a synthesis of ecological examples from different ecosystems worldwide, we demonstrated how herbivory, predation, species movement, invasive species, and vegetation dynamics interact with fire regimes and influence biodiversity and ecosystem functioning (see Plumanns-Pouton et al. 2025).

These analyses were the basis for developing a conceptual framework for restoring fire regimes through rewilding. This framework proposes a sequence of iterative steps that include: (i) characterizing the main ecological processes and abiotic dependencies within the selected ecosystem; (ii) identifying altered and target fire regimes; (iii) selecting appropriate rewilding actions according to socio-ecological contexts; and (iv) monitoring and evaluating restoration outcomes adaptively over time. By linking fire-regime restoration to an iterative diagnosis, intervention selection and monitoring, the framework provides a practical basis for deciding the minimum level of management required to increase resilience to future wildfire conditions.

Finally, the proposed framework was illustrated using examples from different ecosystems, including boreal forests, savannas, Mediterranean systems, and fire-sensitive tropical forests. These examples allowed us to assess how different rewilding actions — such as targeted herbivory, hydrological restoration, adaptive ignition management, reduced suppression, and reintroduction of ecosystem engineers — may contribute to restoring fire regimes depending on ecosystem characteristics and disturbance histories. These examples are not included in this deliverable but see Plumanns-Pouton et al. (2025).

2.3 Workshop on “Rewilding and increasing climate change disturbances”

To finetune the results obtained from the literature review and to get feedback from different case studies on the rewilding & disturbance nexus analyzed in Task 2.2. we held an online workshop entitled “Rewilding and increasing climate change disturbances” (11th and 12th March 2026). The workshop was co-organized with two other research projects focused on rewilding: wildE’s sibling Horizon Europe project WILDCARD (https://wildcard-project.eu/) and the Italian national project REWILDFIRE (https://rewild-fire.com/). The event was organized around three half-day sessions, each one devoted to a specific topic: i) *Harnessing disturbances to promote rewilding*, ii) *The role of rewilding on influencing disturbances* and a third and specific session devoted to wildfires (iii) *On the rewilding & wildfires nexus*, considering this specific disturbance is the one more challenging when addressing the potential threats of rewilding. The topic of each session was introduced by means of 4-6 inspiring short presentations of the projects' results and followed by a general discussion including questionaries and the design of potential favorable rewilding scenarios (see the workshop program in Annex 3). Thirty-four participants from the three co-organizing projects attended the workshop including scientists and stakeholders (see Annex 4 for the list of attendants).

3. Results

3.1. Addressing the rewilding and disturbance nexus

3.1.1 Effects of rewilding on ecosystem resilience

The final dataset included 42 primary studies (Annex 1) published between 1998 and 2024 and distributed across 19 countries covering five continents. As shown in Figure 2A, most studies were conducted in temperate forests (35%), followed by Mediterranean woodlands (29%), temperate and subtropical grasslands/savannas (17%), tropical and subtropical forests (12%), and boreal or montane forests (7%). Regarding ecosystem type, forests accounted for 57% of the studies, while grasslands represented 43%. The main causes of ecosystem degradation motivating rewilding as restoration interventions (Figure 2B) were fire exclusion (22%), livestock overgrazing (19%), agricultural practices (19%), defaunation (14%), plant invasions (12%), forest harvesting (7%), fire (5%), and mining activities (2%). Most studies (93%) focused on active rewilding interventions, whereas passive rewilding approaches represented 7% of the cases. Rewilding actions mainly targeted the biodiversity ("trophic complexity") component (69%), followed by combined biodiversity/disturbance interventions (19%) and disturbance stochasticity alone (12%). We did not find any study exclusively addressed the connectivity component. System variables used to assess resilience were mainly related to demographic processes (37%), biophysical characteristics (27%), and disturbance characteristics (25%), whereas biodiversity-related variables represented 11% of the observations. Disturbance agents were classified as abiotic (41%) or biotic (59%), with fire and drought being the most common abiotic disturbances and biological invasions the dominant biotic disturbance.

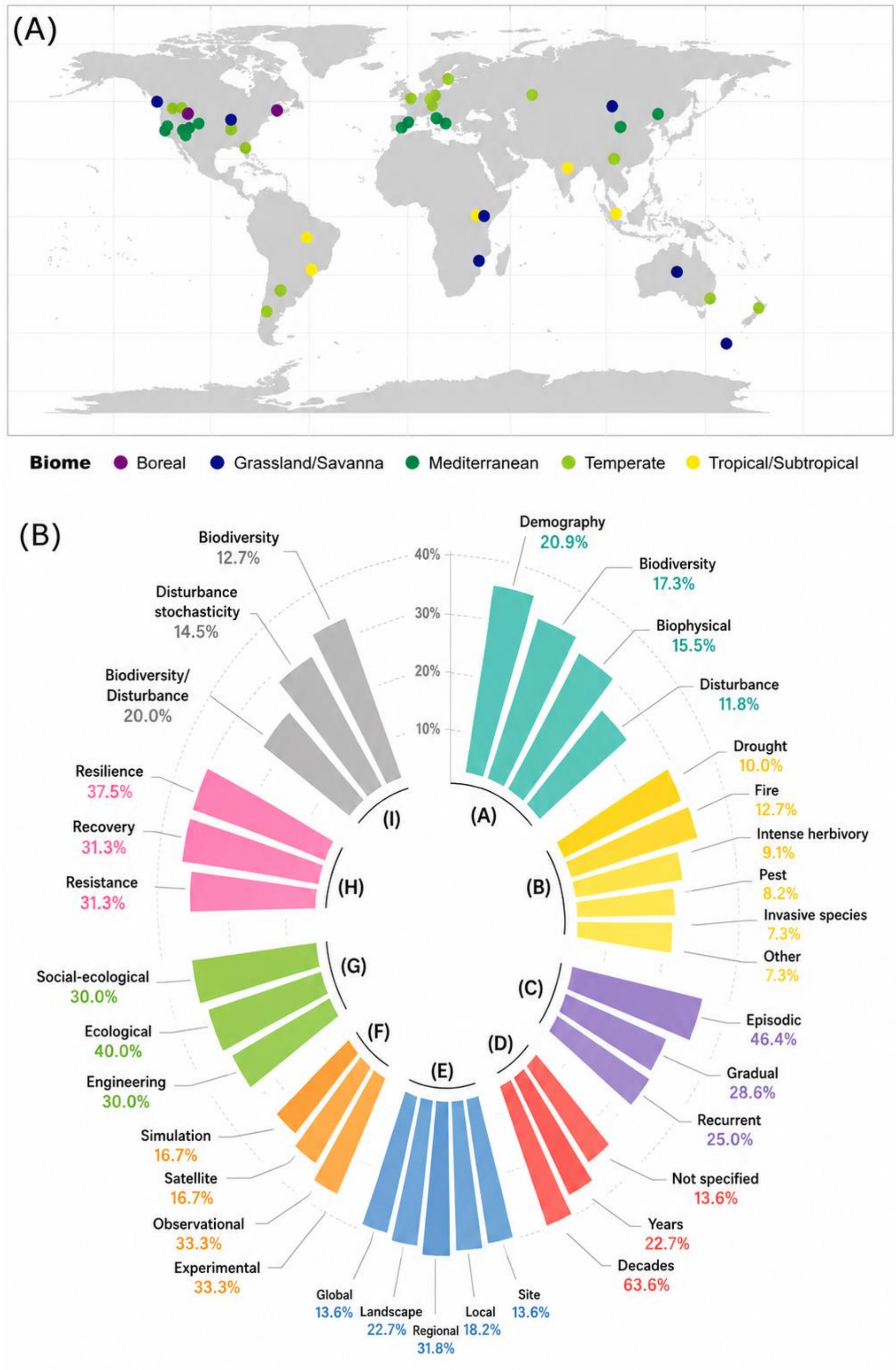


Figure 2. (A) Geographic distribution of the 42 primary studies selected. Each point indicates a study location, and colors illustrate biomes using the global Koppen- Geiger climate classification. (B) Distribution of the Operational Resilience Framework (ORF) elements: A: system variable categories; B: specific disturbance; C: disturbance type; D: temporal scale; E: spatial scale; F: study type; G: resilience approach; H: resilience dimension; I: resilience predictors (i.e., rewilding components). For each ORF element, the number of studies with a particular category is shown. Modified from Selwyn et al. (2025)

Overall, the vote counting exercise revealed that 68.2% of the 305 observations reported positive effects of rewilding on ecosystem resilience, whereas 11.8% showed neutral effects and 20.0% negative effects (Figure 3). Positive resilience outcomes were consistently observed across the three rewilding components considered — biodiversity, disturbance stochasticity, and combined biodiversity/disturbance interventions — as well as across all categories of system variables, including demographic processes, biodiversity, biophysical characteristics, and disturbance regulation (Figure 3).

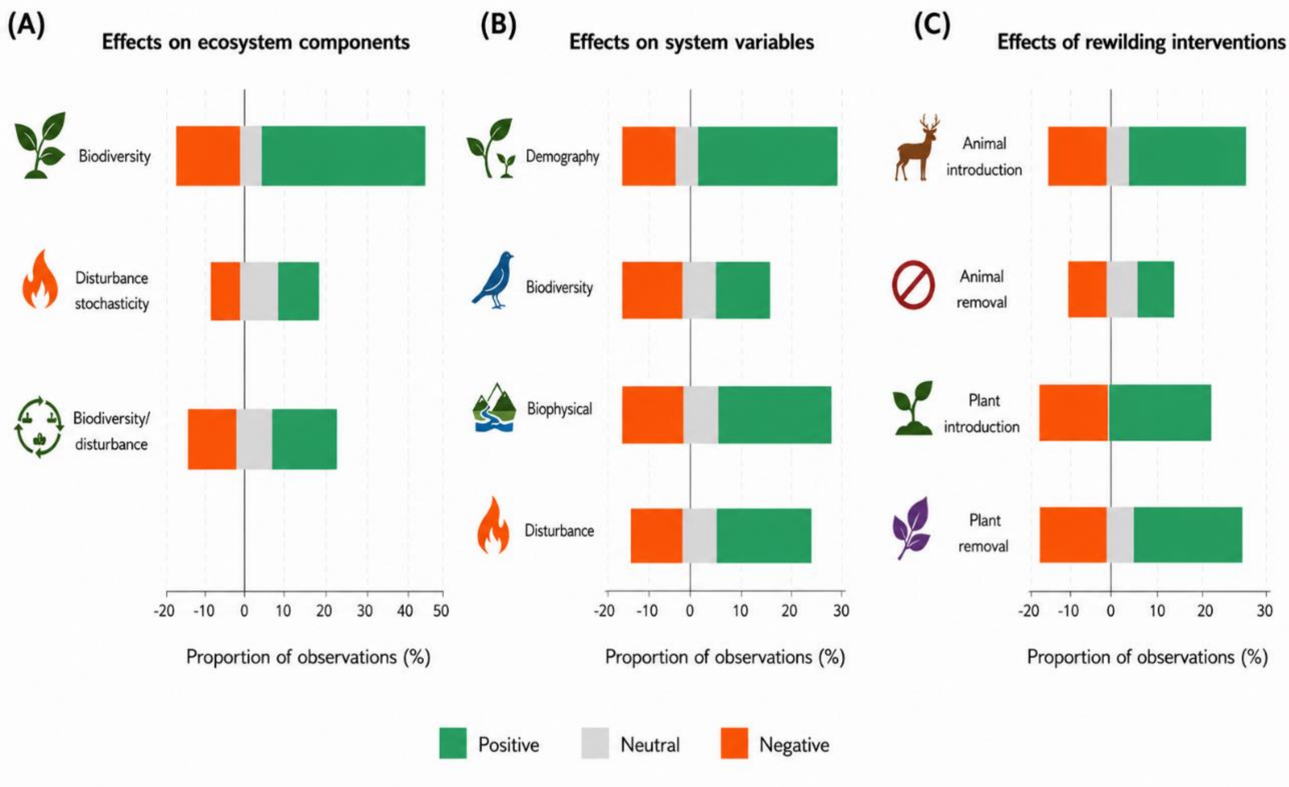


Figure 3. Proportion of observations showing the direction effect (positive, neutral or negative) of (A) rewilding components for ecosystem resilience (n observations = 305, n primary studies = 42), (B) system variable categories for which resilience was assessed (n observations = 305, n primary studies = 42), and (C) specific rewilding interventions aimed at increasing biodiversity (n observations = 190, n primary studies = 26). n is the number of observations and primary studies considered. Note that the proportion of observations represented in each of the bars is not cumulative, but the sum of all bars in each figure sums up to 100%. Modified from Selwyn et al. (2025).

The more precise meta-analysis also pinpointed a significant positive effect of rewilding on ecosystem resilience, although substantial heterogeneity among observations was detected (Figure 4). Positive and significant effects were observed across all system variable categories, including demographic processes, biodiversity, biophysical characteristics, and disturbance regulation. Rewilding also showed positive effects for engineering and ecological resilience approaches, whereas no significant effects were detected for social-ecological resilience. Interestingly, the effects of rewilding differed according to disturbance characteristics. Positive and significant resilience outcomes were found for biotic disturbances, whereas abiotic disturbances showed negative overall effects. Positive effects were consistently observed in both forest and grassland ecosystems.

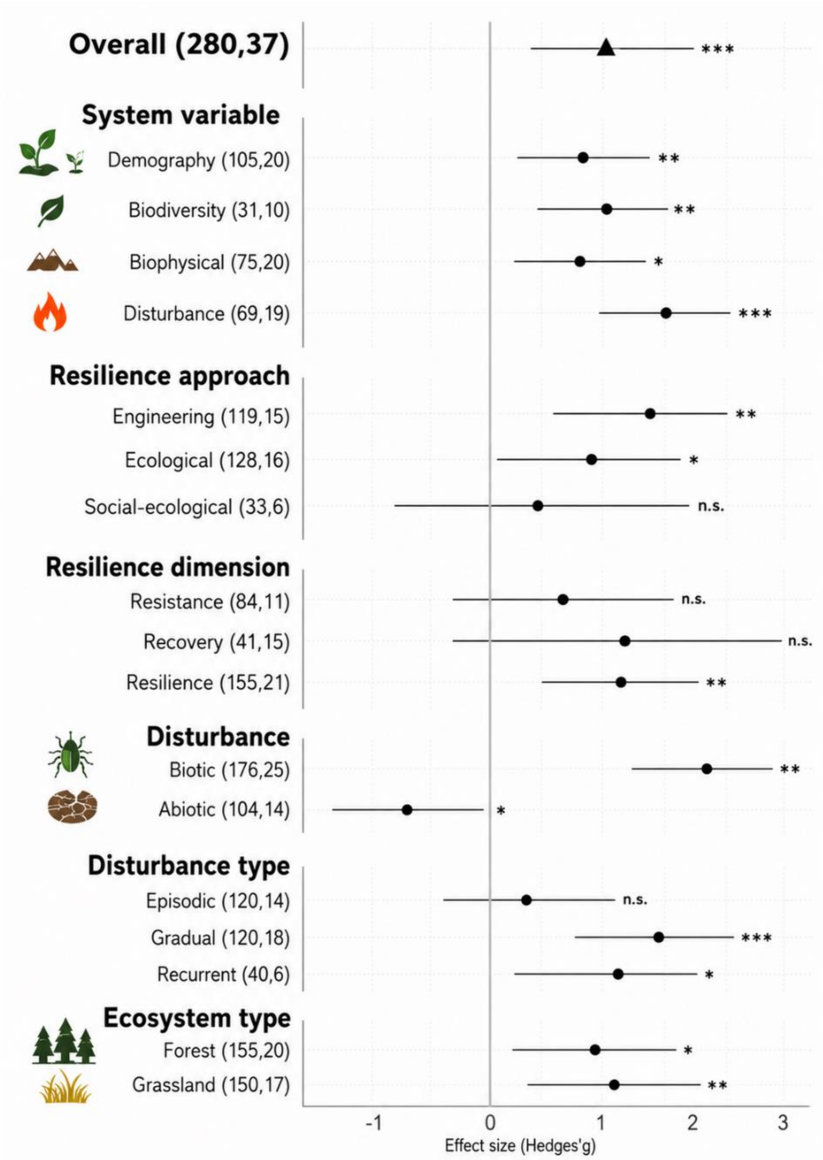


Figure 4. Overall effect size (black triangle) and effect size for each group of moderators (black dots) together with their confidence intervals considering all rewilding components together (biodiversity, disturbance stochasticity, and biodiversity/disturbance). Effect sizes were calculated using Hedges'g. Numbers in parenthesis indicate total number of observations and primary studies, respectively. Significant values are indicated by * ($P < 0.05$), ** ($P < 0.01$), *** ($P < 0.001$), and n. s. (non-significant). Modified from Selwyn et al. (2025).

When considering individual rewilding components separately, biodiversity, disturbance stochasticity, and combined biodiversity/disturbance interventions all showed significant positive overall effects on resilience (Figure 5). However, differences emerged among system variable categories. Biodiversity-focused interventions did not significantly improve biodiversity-related variables, disturbance-focused interventions showed no significant effects on demographic and biophysical characteristics variables, while combined biodiversity/disturbance interventions had positive effects on all variables.

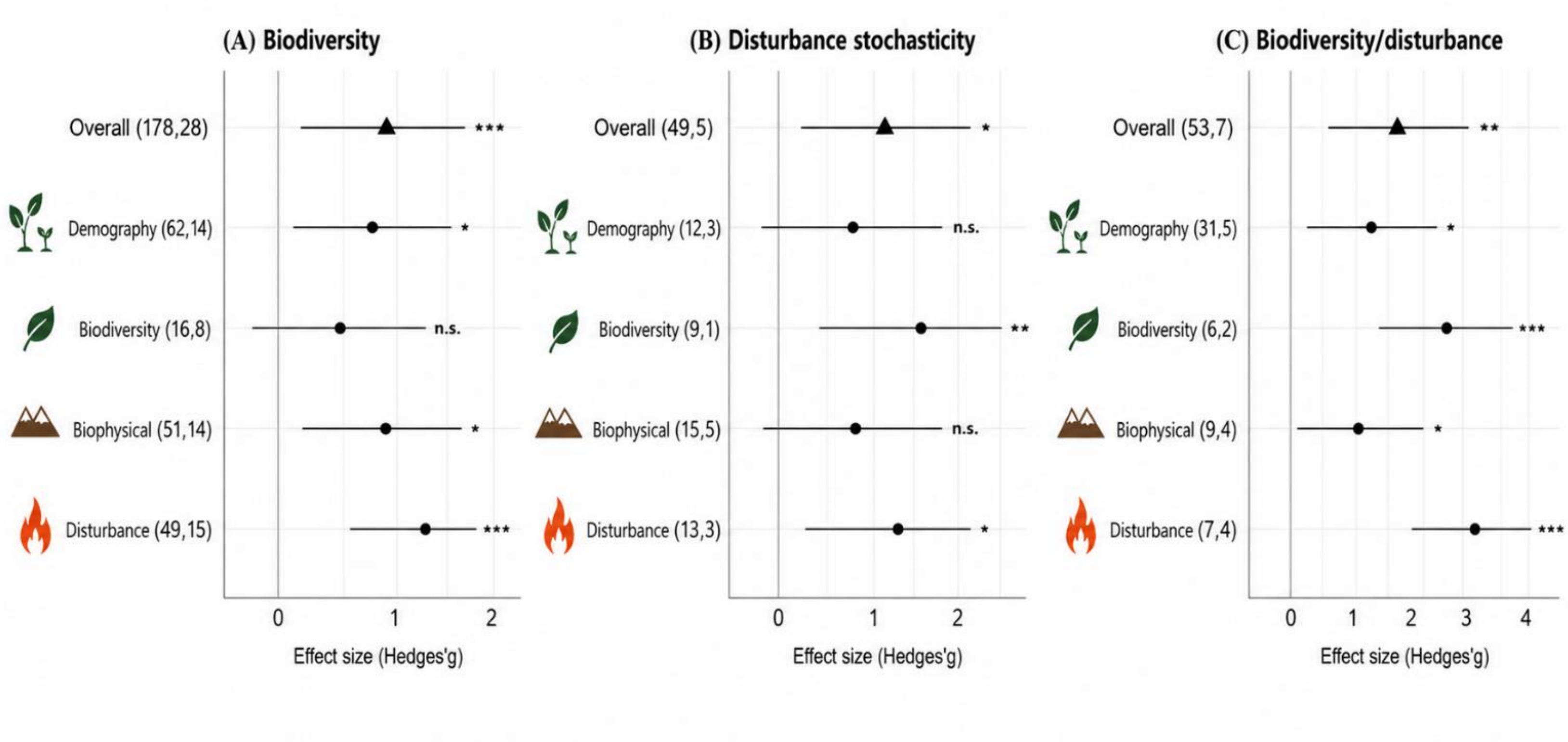


Figure 5. Overall effect size (black triangle) and effect size for each system variable category (black dots) and their confidence intervals for (A) biodiversity, (B) disturbance stochasticity, and (C) biodiversity/disturbance rewilding components. Effect sizes were calculated using Hedges'g. Numbers in parenthesis indicate the total number of observations and primary studies, respectively. Significant values are indicated by * (P < 0.05), ** (P < 0.01), *** (P < 0.001), · (<0.1), and n. s. (non-significant). Modified from Selwyn et al. (2025)

Finally, analyses focusing on biodiversity-related (i.e. increasing trophic complexity) interventions showed significant positive effects of animal introductions, plant introductions, and plant removals on resilience, whereas animal removals did not produce significant effects owing to a extreme variability on the effect sizes (Figure 6). The robustness of all the meta-analytical results was supported by high Rosenthal fail-safe numbers across all analyses (see Selwyn et al. 2025).

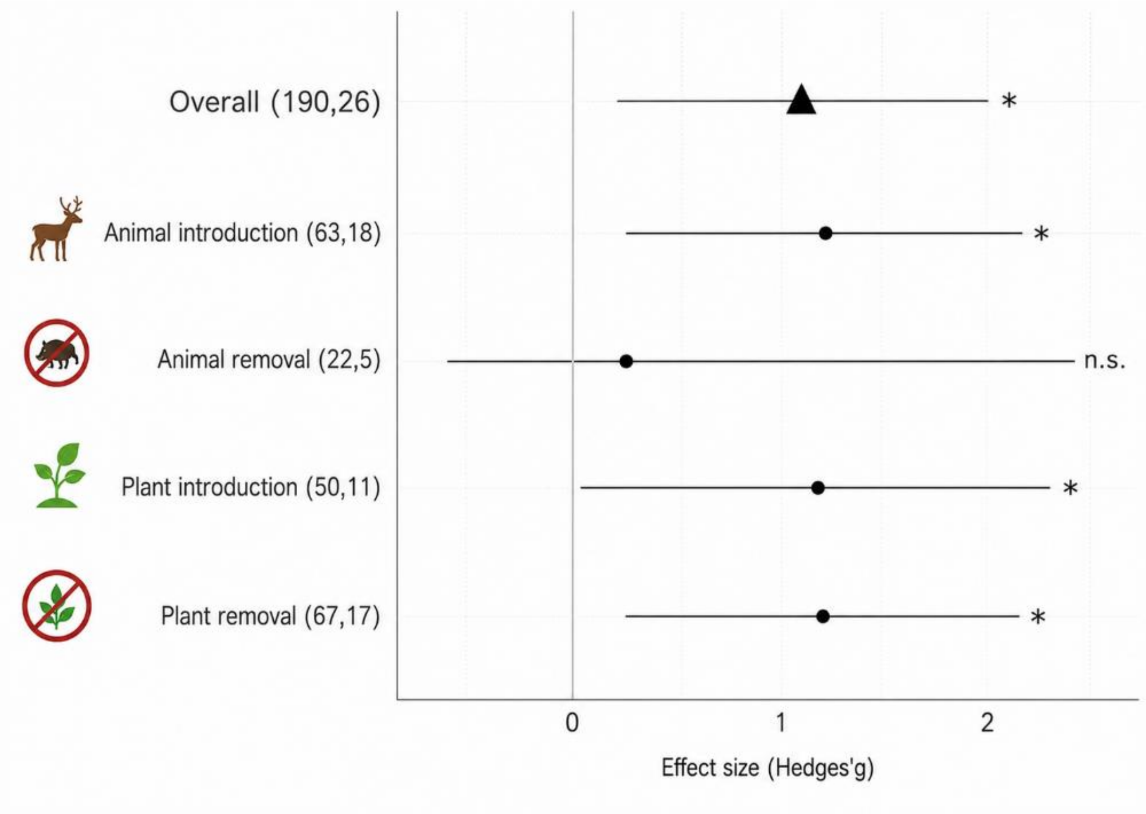
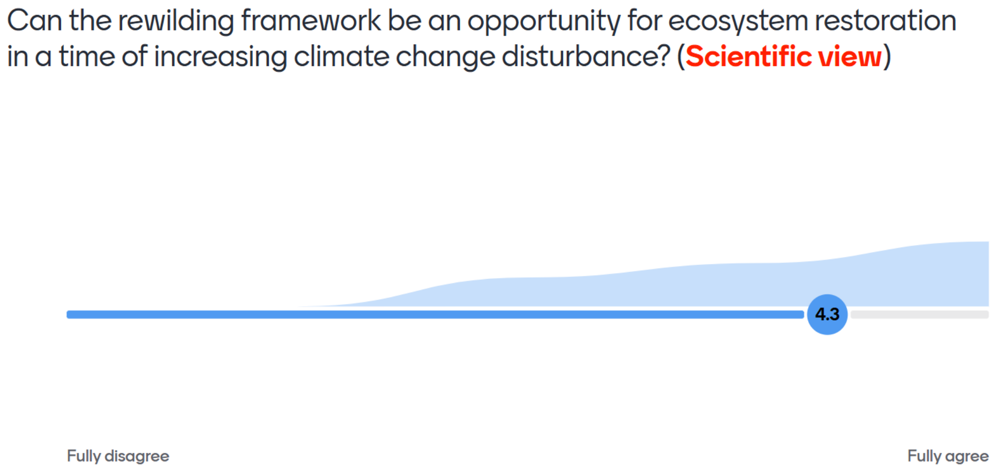


Figure 6. Overall effect size (black triangle) and effect size for each specific biodiversity rewilding intervention (black dots) and their confidence intervals. Effect sizes were calculated using Hedges' g. Numbers in parentheses indicate the total number of observations and primary studies, respectively. Significant values are indicated by * (<0.05) and n. s. (non-significant). Modified from Selwyn et al. (2025)

Results sharing and discussions during the workshop allowed us to finetune and complement the results obtained from the literature review and the analysis of rewilding as a restoration framework Yet, it provided somewhat contrasting results whether the views of scientists or stakeholders are considered. Namely, as shown in Figure 7 while there was a considerable agreement (4.3 upon 6) among scientists on considering rewilding as an opportunity for ecosystem restoration in a time of increasing climate change disturbances, the views of stakeholders seemed to be much more critical, with consensus on the benefits of rewilding only reaching 2.9 upon 6.



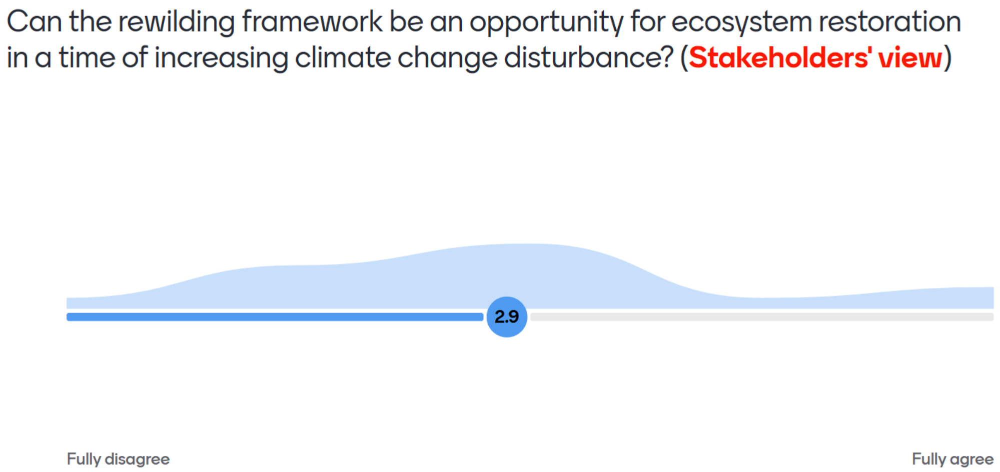


Figure 7. Valorization of rewilding as an opportunity for ecosystem restoration in a time of increasing disturbances (upper panel) by scientists and by stakeholders (lower panel). Fully disagree =1, Fully agree = 6

One of the reasons for such disagreement can be found in the different perceptions of rewilding as a restoration strategy contributing to stabilizing (to maintain) historical disturbance regimes or its potential for increasing disturbance risk under climate change (Figure 8). While scientists consider rewilding as a restoration strategy positively contributing to the maintenance of disturbance regimes on their historical ranges the view of stakeholders is more critical and consider rewilding as a process that may increase the sensitivity of ecosystems to disturbances.

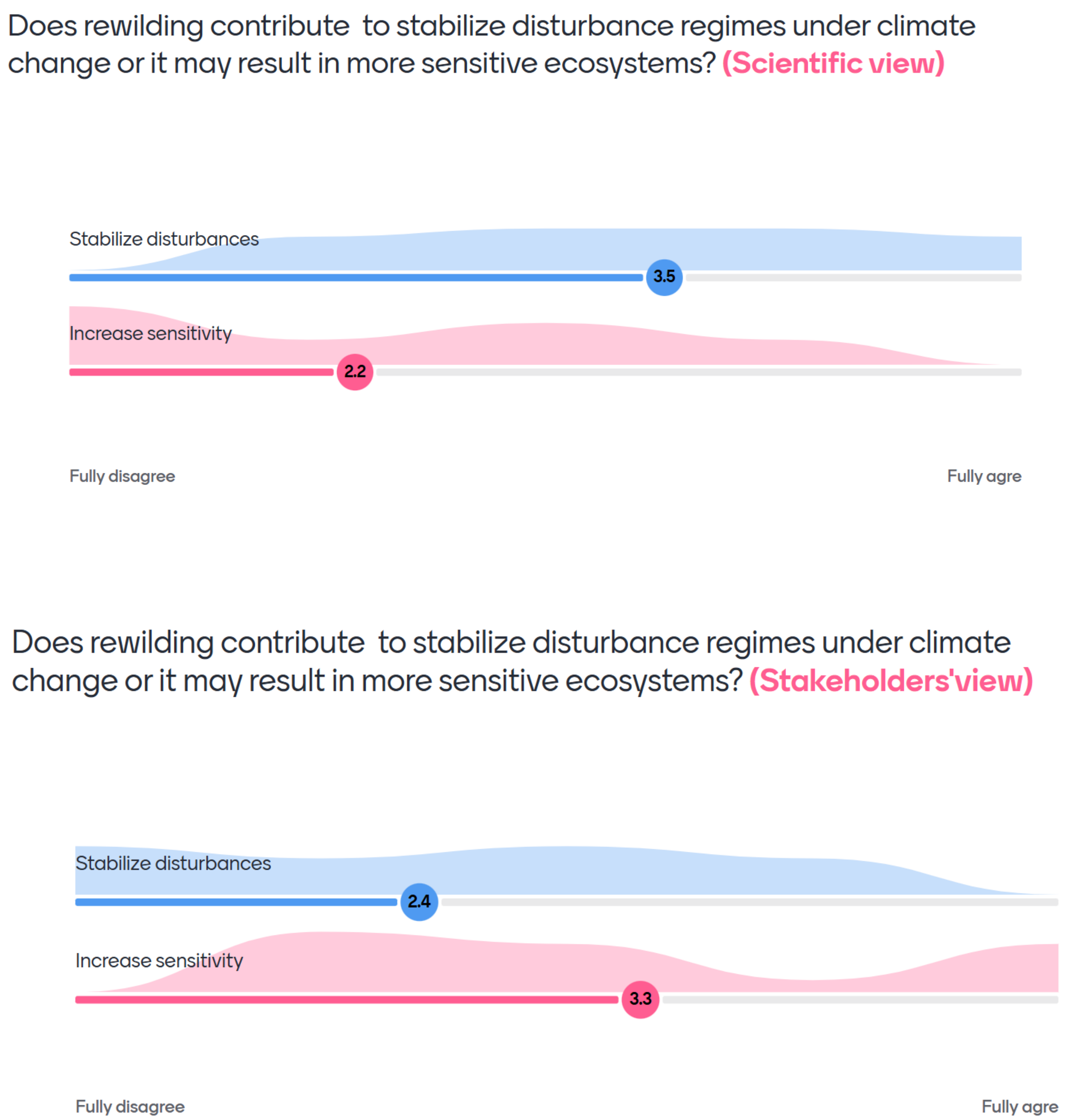


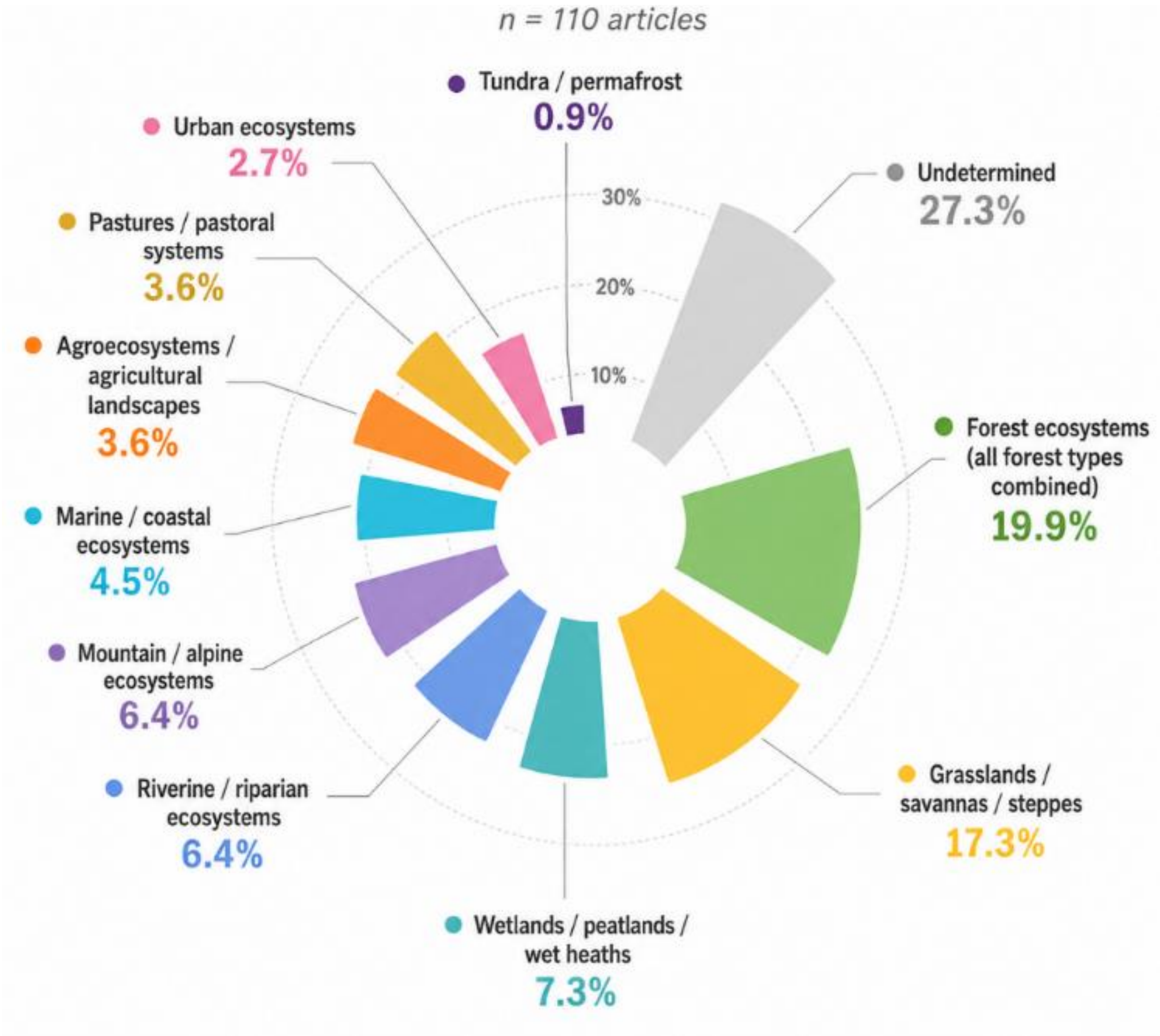
Figure 8. Valorization of rewilding as an opportunity for ecosystem restoration in a time of increasing disturbances (upper panel) by scientists and by stakeholders (lower panel). Fully disagree =1, Fully agree = 6

Although the results of this study based on a literature review report overall benefits of rewilding for biodiversity restoration and increasing resilience, the limitations of this evidence must be acknowledged. Indeed, the studies analyzed concerned active, intentional rewilding projects, while the effects of increased connectivity were scarcely addressed, owing to the lack of specific literature on this process in rewilding restoration practices. In this regard, it should be noted that biomass accumulation resulting from passive, unintended rewilding, together with increased connectivity, were precisely the two main threats associated with a potential increase on disturbances linked to this practice (see next section, according to the literature review and the workhsop.

3.1.2 Effects of rewilding on disturbances

As shown in Figure 9A, from the final dataset of 110 studies retained (Annex 2), a significant number of them did not include precise information on the type of ecosystem analyzed (27%) as they were mainly theoretical and perspective studies. For those which included information, the most abundant ones corresponded to forests (20%), grasslands (17%) and wetlands (7%). After excluding anthropogenic land-use/human disturbances (44% of studies), the main post-rewilding disturbances reported in the 64 studies retained (Figure 9B), corresponded to herbivory/grazing/browsing (55%) mostly related to projects that aimed at the re-introduction of large wild herbivores, unspecific disturbances (13%), fire (9%), climate related disturbances such as storms or drought (8%), pests (6%) and multiple mixed disturbances (5%).

A)



B)

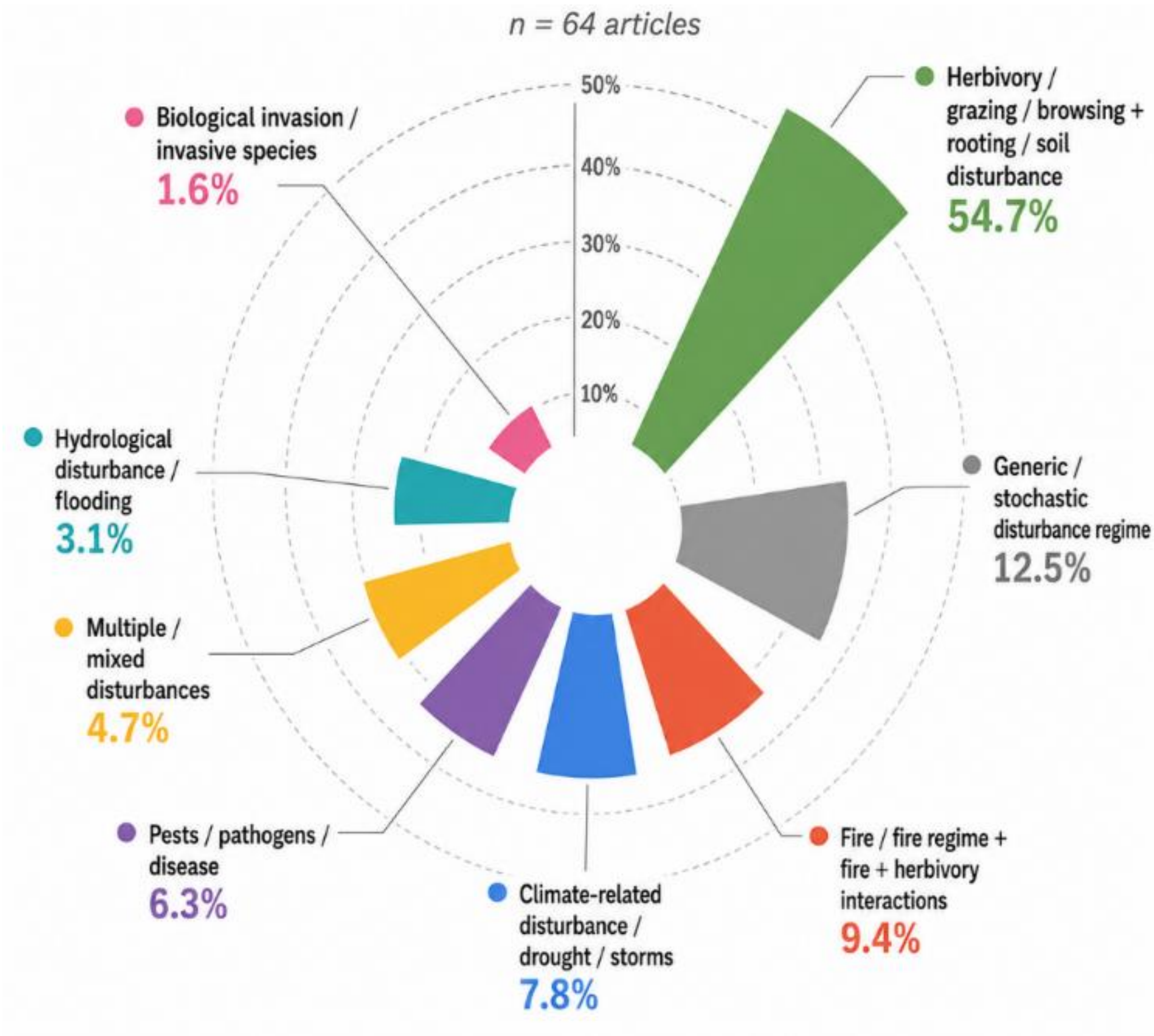


Figure 9. (A) Geographic distribution of the studies where the occurrence of disturbances after rewilding activities has been analyzed. (B) Types of post-rewilding disturbances analyzed.

To carry out an initial analysis of the dynamics of disturbances following the application of the rewilding framework, we separated the set of disturbances corresponding to the effects of the reintroduction of large herbivores (e.g., grazing, browsing, trampling), as these disturbance effects were to some extent expected o even intended, from the remaining types of unintended disturbances ("Other disturbances" including fire, drought, pests and others). As shown in Figure 10, the re-introduction of large herbivores aimed at increasing trophic complexity, resulted in an increase in browsing, grazing and other indirect effects (trampling), generally considered to be a positive effect of this rewilding practice, although some negative effects have been also acknowledged (Table 3). On the other hand, and for unintended disturbances ("other disturbances") the results were more heterogeneous and included positive, negative and neutral effects of rewilding on disturbance increase (Figure 10). These results are aligned with those shown in the previous section, which reported that despite the overall positive effects of rewilding on increasing ecosystem resilience (70% of observation), this restoration framework might also have no positive effects on 30% of the cases analyzed (20% neutral and 10% negative), particularly regarding abiotic disturbances.

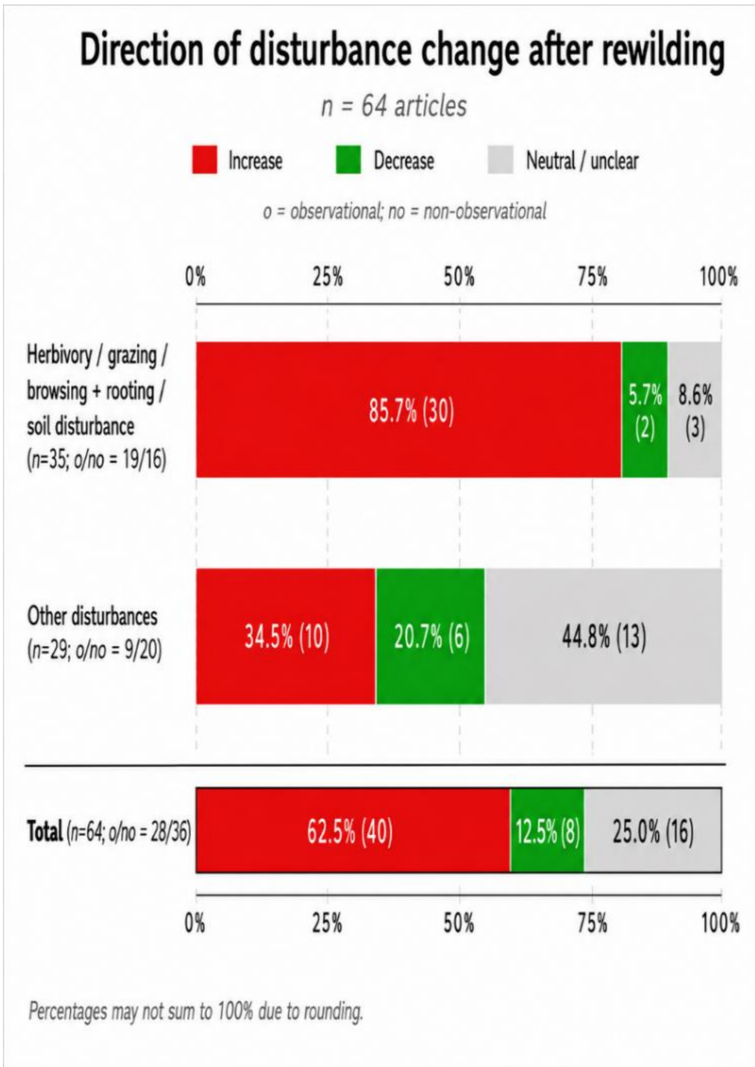


Figure 10. Effects of rewilding on increasing, decreasing or having a neutral effect on disturbances associated to the re-introduction of large herbivores (e.g. herbivory, grazing, browsing, rooting, soil disturbance) and other disturbances

When the category "Other disturbances" was split into the different disturbances, it can be observed that rewilding reached only a moderate percentage of situations where a decrease in disturbance occurrence is detected (Figure 11). Yet these results must be cautiously considered as the number of studies in some categories is low and for some of them there is a high number of non-observational studies (modeling, analysis of perceptions, etc.).

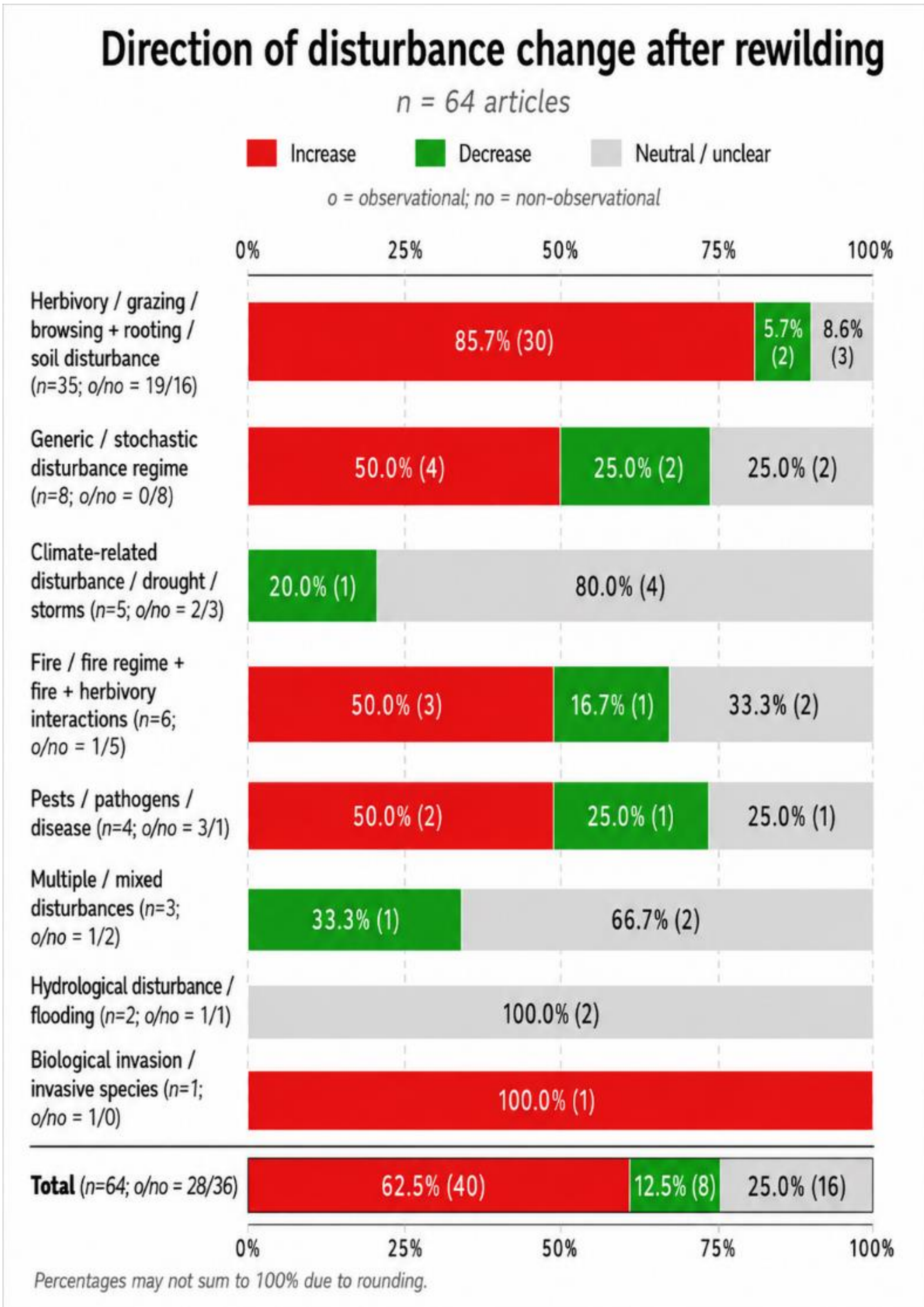


Figure 11. Effects of rewilding on increasing, decreasing or having a neutral effect on different types of disturbances. For each disturbance the number of studies is indicated (n) as well as whether these studies were observational (o) or non-observational (no).

According to this literature review, the main causes of the potential negative effects of rewilding on increasing disturbance risks were associated to four main processes:

i) "maladaptation" of the restored ecosystem to future environmental conditions,
ii) negative effects of a too sudden change in the management regime,
iii) negative effects of increased connectivity, particularly for the spread of wildfires, pests and exotic species
iv) negative effects of biomass accumulation for wildfire risk and competition for resources.

A more detailed description of these main disturbance drivers identified in the literature is provided in Table 3. The main post-rewilding disturbance drivers reported in the literature appeared overall aligned with the information gathered during the workshop (Figure 12) as attendants indicated that the main threat associated with the potential negative effects of rewilding for increasing disturbances was the increase in fuel load and continuity in the landscape for wildfires, followed by the threats associated to the potential spread of invasive species, and the potential increase in pests outbreaks. However, attendants of the workshop also identified problems connected with fauna and its interaction with humans as a potential relevant problem associated with rewilding, while we did not capture it in our literature review, probably as this phenomenon was not identified as a disturbance in the scientific literature.

As shown in Table 3, to mitigate this potential increase in disturbances associated with rewilding actions, the literature consistently highlighted the importance of focusing on adaptive and context-specific management approaches rather than a complete abandonment of intervention (passive rewilding). Key strategies would include maintaining "functional" herbivory through appropriate densities of wild or domestic grazers to control fuel accumulation and preserve the biodiversity of open habitats, combining grazing with prescribed burning or selective fuel management to reduce wildfire risk, with the aim of maintaining disturbance regimes in a controlled and ecologically functional manner. Several studies also emphasize the need to move beyond rigid historical restoration targets and instead adopt forward-looking approaches that account for future climatic conditions (e.g. increasing drought), promoting the use of better climate-adapted species, maintaining ecological connectivity to facilitate species migration, and protect climate refugia. In addition, long-term monitoring, the design of adaptive management frameworks, and clearly defined intervention thresholds are considered essential to detect and correct the abovementioned unintended and negative ecological effects. On top that, the literature further stresses the importance of integrating participatory governance, stakeholder engagement, and hybrid management models that combine rewilding with traditional land-use practices, in order to maintain cultural landscapes and reduce social conflicts.

Overall, the main recommendation emerging from the analysis of the rewilding and disturbance nexus, is that rewilding can increase ecosystems resilience to climate change driven disturbances, particularly for those caused by biotic agents. Yet, it should not be understood merely as a passive "non-intervention" strategy, but rather as an adaptive process requiring continuous ecological assessment and flexible management. Taken together, the recommendations derived from the literature review specify minimal interventions that can be used to keep rewilding trajectories aligned with landscape resilience under increasing climate-change driven disturbances.

Figure 12. Main process or risk factors increasing the occurrence of disturbances in rewilding projects as identified in the scientific literature (left column) and as reported in the workshop held to address rewilding and increasing climate change disturbances (right column). n = number of comments reporting the effect on the workshop.

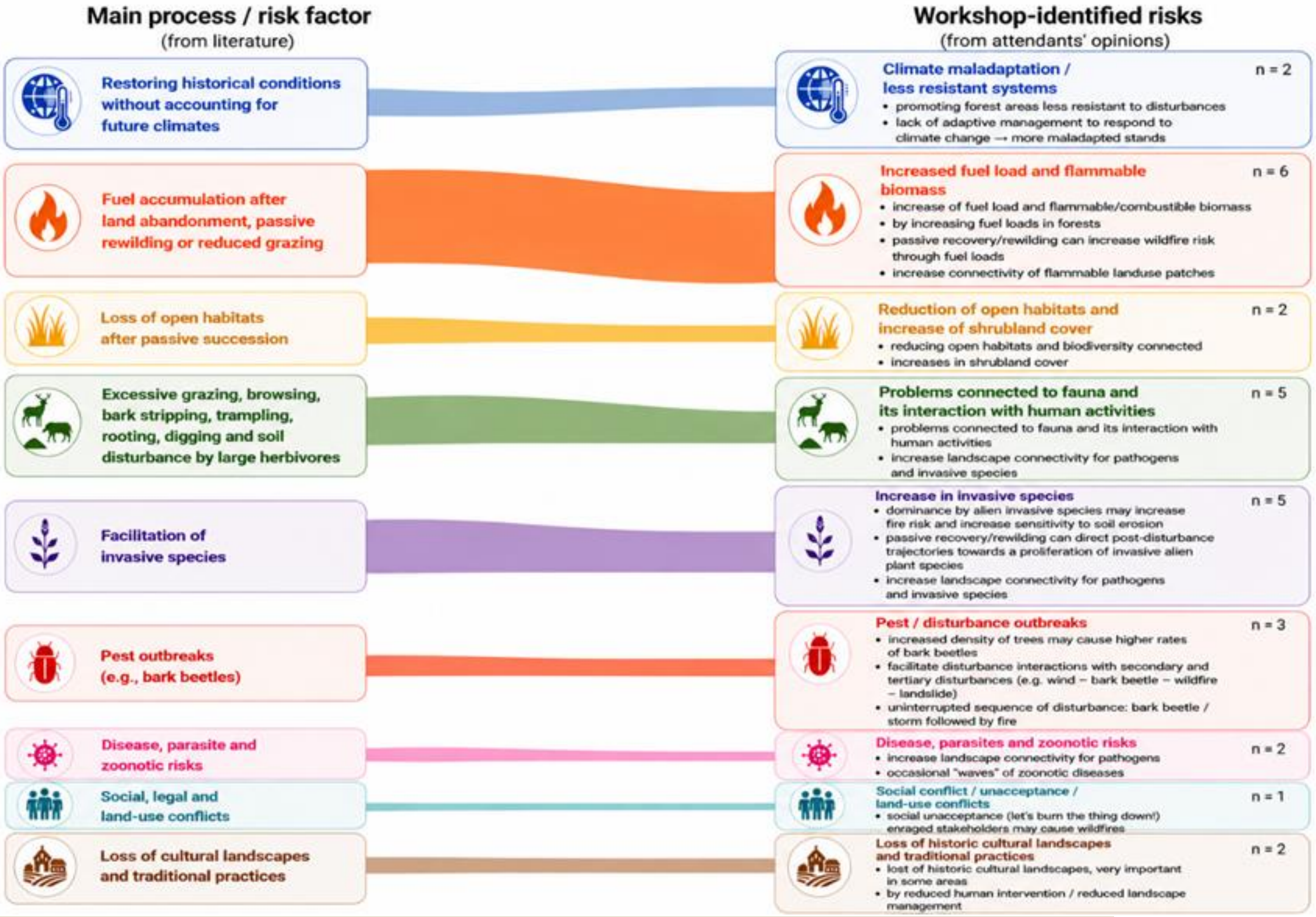


Table 3. Main potential risk factors and potential negative effects after rewilding on increasing disturbances and how to mitigate them. Different colours are used to link similar or highly connected processes and risks. See Annex 5 for the specific list of references included in this table

Main process or risk factor	Potential negative effect	References for negative effects	How to reverse or mitigate the risk	References for mitigation
Restoring historical conditions without accounting for future climates	Historical reference ecosystems may be poorly adapted to future disturbances (e.g. drought)	Carroll & Noss 2021; Corlett 2016; Blumroeder et al. 2022.	Use forward-looking restoration targets, promote connectivity along environmental gradients to favor species migration and adopt adaptive management focused management.	Carroll & Noss 2021; Corlett 2016.
Fuel accumulation after land abandonment, passive rewilding or a sudden in grazing	Shrub and tree encroachment may promote Increased fuel accumulation and vertical/horizontal continuity, resulting in higher wildfire vulnerability, intensity and spread.	Kamp et al. 2025; Plumanns-Pouton et al. 2025; Campos et al. 2021; Salis et al. 2022. Fuhlendorf et al. 2009. Rouet-Leduc et al. 2021; Johnson et al. 2018;	Model and monitor post-rewilding fuel loads, reintroduce or maintain controlled herbivory, combine grazing with prescribed burning or selective fuel management	Rouet-Leduc et al. 2021; Plumanns-Pouton et al. 2025; Navarro-Rosales et al. 2025. Fuhlendorf et al. 2009 ;
Loss of open habitats and species associated after passive succession	Scrub encroachment promotes the decline of species that depend on open or early-successional habitats.	Herrando et al. 2016; Schröer et al. 2024.	Maintain open-habitat dynamics through grazing, browsing, mowing, prescribed burning. Apply rotational disturbances	Fuhlendorf et al. 2009; Plumanns-Pouton et al. 2025; Navarro-Rosales et al. 2025.
Excessive grazing, browsing, bark stripping, trampling, rooting, digging and soil disturbance by large herbivores	An excess of herbivores may favor vegetation degradation, reduced regeneration, habitat loss, tree damage, altered plant successional trajectories and soil disturbance	Bescond-Michel et al. 2025; Sharp et al. 2024; O'Loughlin et al. 2024; Afonso et al. 2024. Sandom et al. 2013; van Leeuwen et al. 2025.	Regulate herbivore densities, use exclusion plots or temporary fencing, Restore predator processes where feasible or apply adaptive population control.	Mysterud 2006; Carver et al. 2021; Irob et al. 2024. Carver et al. 2021;
Facilitation of invasive species	Exotic plants may be favored through increased continuity in vegetation, disturbance or trophic interactions.	Ho et al. 2023; Assis et al. 2021; Cava et al. 2018.	Monitor rewilding intervention for early detection, rapid response, and targeted invasive control.	Derham et al. 2018; Thompson et al. 2025.
Pest outbreaks	Vegetation accumulation and connectivity and stochastic disturbances may favor pest spread and outbreaks	Kärvemo et al. 2014; Müller et al. 2022.	Define acceptable disturbance thresholds, retain deadwood where compatible, and intervene near high-risk areas.	Kärvemo et al. 2017 ; Hlásny et al. 2019; Carver et al. 2021;

Main process or risk factor	Potential negative effect	References for negative effects	How to reverse or mitigate the risk	References for mitigation
Disease, parasite and zoonotic risks	Reintroductions and wildlife recovery may increase disease-management challenges.	Ecke et al. 2025; Hu et al. 2023.	Conduct health screening before reintroductions, model and monitor diseases and coordinate wildlife–livestock–human health	Mathews et al. 2006 ; Carver et al. 2021 ; Prist et al. 2023
Social, legal and land-use conflicts	Opposition linked to livestock, land ownership, animal welfare or competing socio-economic interests.	Pérez-Barbería et al. 2023; Gordon et al. 2021; Segar et al. 2022;	Use participatory planning, stakeholder co-design, compensation schemes, transparent governance and conflict-resolution schemes	Butler et al. (2021) Auster et al. (2021) König et al. (2021) Carver et al. 2021;
Loss of cultural landscapes and traditional practices	Passive rewilding may lead to loss of traditional land-use systems and associated biodiversity.	García-Ruíz et al. 2020; Acha & Newing 2015.	Promote hybrid models combining rewilding with extensive grazing, cultural landscape conservation and local livelihood support.	Mutillod et al. 2024; Carver et al. 2021.

The results of our analysis of the rewilding and disturbance nexus reported on this deliverable are aligned with those reported in deliverable 2.1 "*Rewilding enablers and constraints in rewilding cases*", where natural disturbances are identified as one of the factors that can both enable and constrain rewilding in the wildE case studies, depending on the context. As an enabler, natural disturbances were viewed as ecological processes that can increase landscape resilience, support climate-change adaptation and mitigation, and reduce the impacts of extreme events. In this sense, disturbances were not considered simply as threats to be avoided, but as processes that rewilding can use to restore ecosystem dynamics. Across the full set of wildE case studies, natural disturbances emerge as a relatively important enabler, but not as the single dominant one (see deliverable report D2.1). Disturbances rank among the main enabling factors (third out of sixteen enablers), just after regional land-use trends and public co-benefits and with similar importance than harvesting opportunities and policy congruence (see Table 2 in deliverable D2.1). Their importance is especially clear for the ecological and biophysical perspective and for climate-change adaptation, where disturbance-based dynamics can directly improve ecosystem functioning and resilience. Yet, natural disturbances are also viewed as potential constraints for rewilding as fire, floods, droughts, windstorms and pest outbreaks are also perceived in the case studies as hazards, particularly by land managers or private companies operating in risk-prone regions. In such cases, conventional management is preferred to suppress or prevent disturbances, making it difficult to use them as a rewilding tool. Across case studies, this appears especially relevant in forestry or Mediterranean contexts, where fire risk, drought or pest outbreaks can reduce the willingness to experiment with less controlled management approaches. Yet, the consideration of disturbances as a constraint is relatively weak (nineth out of sixteen constrains, and more case-specific than enablers. Therefore, the general conclusion is that rewilding cases are more strongly enabled than constrained by disturbances, and that constraints tend to be idiosyncratic to particular case studies.

The specific case-study comparison shows both commonalities and clear differences. A key similarity is that natural disturbances often operate in both directions: i.e. they were identified as simultaneously enabling and constraining rewilding in five case studies in wildE (Antarr, Coillte, Sveaskog, Baixo Sabor and Tatras). Yet out of this similarity, differences among cases are substantial:

- In Tatras, natural disturbances are one of the strongest enablers, but disturbance-related risks also appear among the main constraints.
- In Baixo Sabor, a fire-prone area, natural disturbances appear more as a constraint than as a top enabler.
- In Sveaskog, natural disturbances are among the top enablers, but the case is characterized by weak overall enabling conditions and many constraints.
- In Coillte, disturbance-related issues are also part of a broader pattern in which many factors act simultaneously as enablers and constraints.
- In Gelderse Poort rewilding is strongly enabled by natural disturbances with no constrain effects.
- Antarr, Ruhrgebiet and the Barcelona Metropolitan Region show weaker or more moderate roles for disturbances compared with other factors such as land ownership, public co-benefits, policy congruence, regional land use, area size and surrounding nature connectivity.

Overall, the information gathered at the case study level informs that natural disturbances are important because they are placed at the core of what rewilding tries to restore: self-regulating ecological processes. Yet their practical role as an enabler or a constraint may strongly depend on local governance, land-use context, risk perception and management culture. They are most enabling where disturbance dynamics can be accepted and integrated into restoration goals, and most constraining where these are perceived mainly as hazards that threaten economic activities, safety or conventional management objectives.

Research outputs. Part of the results included in this section have been already published in a scientific journal

Selwyn, M., Lázaro-González, A., Lloret, F., Benayas, J. M. R., Hampe, A., Brotons, L., Pino, J., & Espelta, J.M. (2025). Quantifying the impacts of rewilding on ecosystem resilience to disturbances: A global meta-analysis. *Journal of Environmental Management*, *375*, 124360.

3.2. Restoring fire regimes through rewilding

3.2.1 Defining fire regimes and "fire switches"

Fire regimes are characterized by the frequency, seasonality, intensity, severity, size, and spatial configuration of fire events over time, shaping ecosystem structure, species composition, and ecological functioning across landscapes (Keeley et al., 2011; He et al., 2019). Fire occurrence depends on the interaction among several key "fire switches": fuel availability, fuel dryness, ignition sources, fire weather, and fire suppression (Table 4), with the relative importance of each varying among ecosystems (Bradstock, 2010). For example, fuel-limited ecosystems, such as xeric shrublands, are primarily constrained by biomass availability, whereas wildfire in climate-limited systems, such as rainforests, are more strongly regulated by precipitation and fuel moisture (Pausas & Ribeiro, 2013). These fire switches are intrinsically linked to ecological processes such as herbivory, vegetation dynamics, and hydrological conditions, making fire regimes central components of ecosystem functioning and resilience. Understanding how these ecological and climatic drivers interact is therefore essential for identifying altered fire regimes and for developing rewilding approaches capable of restoring ecologically functional disturbance (wildfire) dynamics.

Anthropogenic pressures such as climate change, fire suppression, land abandonment, urbanization, plantations, agricultural conversion, grazing intensification, hydrological alteration, species introductions, and herbivore extinctions have profoundly modified fire regimes worldwide (Bowman et al., 2020; Kelly et al., 2020). These drivers alter fuel loads, fuel continuity, ignition patterns, vegetation moisture, and suppression dynamics, frequently increasing fire size, severity, and spatial homogeneity (Table 4). In fire-sensitive ecosystems such as tropical rainforests, increasing anthropogenic ignitions combined with deforestation and land conversion have promoted ecosystem degradation, altered species assemblages, and transitions towards alternative ecosystem states (Cochrane & Barber, 2009). Conversely, in many fire-prone ecosystems, decades of suppression and land abandonment have increased fuel accumulation and reduced landscape heterogeneity, favoring megafires and decreasing pyrodiversity (Pausas &

Keeley, 2019). Altered fire regimes affect vegetation structure, soil properties, trophic interactions, biodiversity patterns, and ecosystem functioning, threatening ecological resilience and the socio-ecological services on which human societies depend. These changes demonstrate the urgent need to restore ecologically functional fire regimes capable of sustaining biodiversity and ecosystem resilience under global change.

Table 4. Potential of anthropogenic pressures to alter fire regimes by modifying four key fire switches: fuel availability, fuel dryness, ignition dynamics, and suppression patterns. These changes frequently increase fire severity, spatial continuity, and ecological homogenization, thereby reducing ecosystem resilience and biodiversity. Modified from Plumanns-Pouton et al. (2025)

Anthropogenic presssues	**Fire switch affected**	**Mechanisms altering fire regimes**	**Resulting fire-regime effects**
🌍 **Climate change**	Fuel dryness / Fire weather / Suppression efficacy	Increases vegetation desiccation, lengthens fire-weather periods, and reduces suppression effectiveness	More frequent, severe, and spatially homogeneous wildfires
🚒 **Fire suppression**	Suppression / Fuel availability	Reduces occurrence of small fires while promoting long-term fuel accumulation	Greater probability of infrequent but high-severity megafires
🏙️ **Urbanization**	Ignition source / Fuel availability / Suppression	Increases accidental ignitions, fragments vegetation, and intensifies the need to protect assets	Higher ignition probability but reduced local fire spread
🌱 **Land abandonment**	Fuel availability	Accumulation and continuity of vegetation following agricultural abandonment	Larger, more continuous, and more severe fires
🔥 **Exclusion of traditional burning**	Ignition source / Fuel availability	Suppression of Indigenous and traditional burning practices increases fuel build-up	Decline of heterogeneous low-intensity fires and increase in severe fires
🌲 **Plantation forestry**	Fuel availability	Expansion of continuous stands of highly flammable species	Increased fire size, intensity, and spatial continuity
⚔️ **Conflict and war**	Ignition source	Increase in ignitions caused by weaponry and military activity	Increased fire frequency
🚜 **Agricultural conversion**	Fuel availability / Ignition source	Fragmentation reduces fuel continuity while burning practices increase ignitions	Context-dependent increases or decreases in fire frequency
🪓 **Forest logging**	Fuel availability / Fuel dryness	Alters canopy structure, fuel connectivity, and microclimatic conditions	Modified fire size, intensity, and recurrence
🐄 **Herding or grazing**	Fuel availability	Reduction of biomass and fuel continuity through herbivory	Reduced fire frequency and fire spread
💧 **Hydrological interventions**	Fuel dryness	Alteration of hydrological cycles reduces vegetation moisture	Increased fire frequency and intensity
🌿 **Plant introductions**	Fuel availability	Changes vegetation flammability and fuel structure	Altered fire intensity and fire recurrence
🦌 **Herbivore removals or extinctions**	Fuel availability	Biomass accumulation and increased fuel continuity after loss of herbivory	Greater likelihood of large, severe, and connected fires

3.2.2 The interaction of fire and other ecological processes in the rewilding framework

Fire is strongly interconnected with trophic complexity and dispersal, two ecological dimensions central to rewilding (Perino et al., 2019). Fire influences demographic processes, species distributions, habitat structure, and trophic interactions, while trophic dynamics and species movements simultaneously can shape fire regimes through their effects on fuel loads, vegetation connectivity, and ignition patterns (Figure 13). On the other hand, herbivores may reduce biomass accumulation and fire intensity through grazing and browsing, whereas invasive plant species can increase vegetation flammability and promote positive vegetation–fire feedbacks (D'Antonio & Vitousek, 1992). Fire can also facilitate or restrict dispersal processes by modifying habitat connectivity and resource availability, thereby influencing species diversity, functional diversity, and ecosystem resilience. Reciprocal interactions between fire, trophic complexity, and dispersal create complex ecological loops and feedbacks that regulate landscape heterogeneity and ecosystem functioning across spatial scales (Figure 13). Understanding these interactions is therefore essential for designing rewilding strategies capable of restoring disturbance regimes while maintaining ecological resilience under increasingly novel environmental conditions.

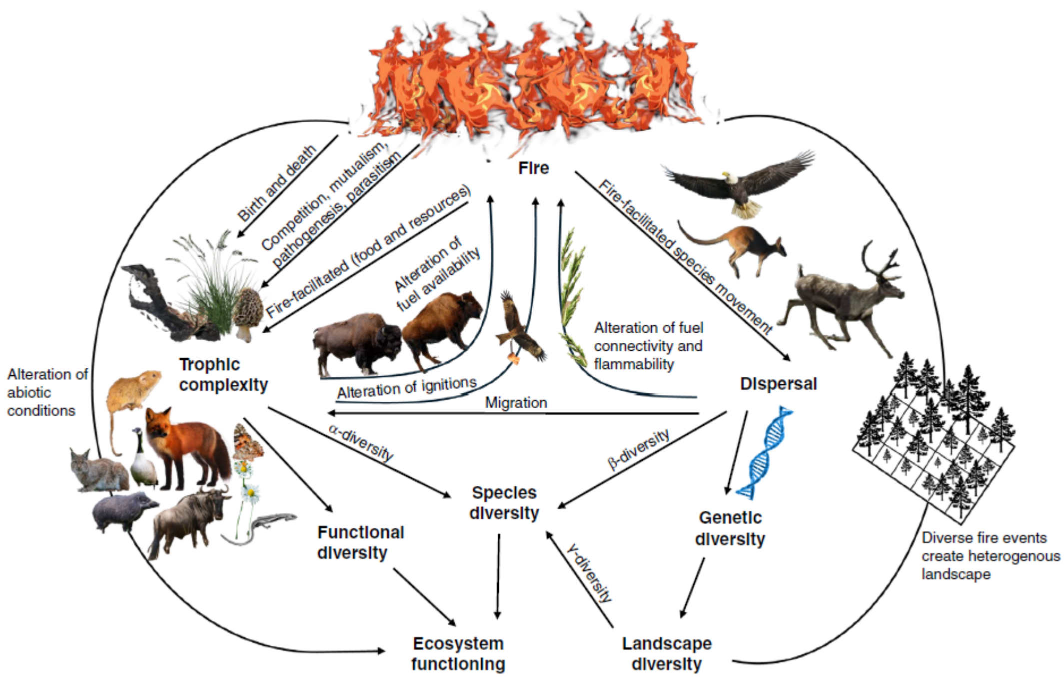


Figure 13. Fire regimes are shaped by the interaction between abiotic drivers, human activities, and ecological processes operating across multiple spatial and temporal scales. Trophic complexity and dispersal strongly influence fuel availability, vegetation structure, ignition dynamics, and landscape connectivity, while demographic processes and stochastic disturbances further modify ecosystem responses to fire.These interactions determine key fire-regime characteristics such as frequency, intensity, severity, and spatial heterogeneity, ultimately affecting biodiversity, ecosystem functioning, ecosystem services, and socio-ecological resilience. Rewilding seeks to restore these ecological processes and feedbacks to recover more functional, heterogeneous, and climate-resilient fire regimes. Extracted from Plumanns-Pouton et al. (2025)

3.2.3 Approaches to restoring fire regimes and potential rewilding actions

Restoring fire regimes will require defining ecologically functional targets capable of sustaining ecosystem resilience under rapidly changing environmental conditions. Historical fire regimes, species' ecological tolerances, and future climatic conditions all provide relevant reference points, although restoration cannot rely exclusively on fixed historical baselines (Hobbs et al., 2009). A process-oriented rewilding perspective instead focuses on restoring the ecological interactions and disturbance dynamics that maintain self-regulating ecosystems under increasingly novel conditions. Key ecological processes linked to trophic interactions, dispersal, demographic dynamics, and disturbance regimes can be used to define the ecological limits within which fire regimes remain compatible with biodiversity persistence and ecosystem functioning. Ecological indicators such as species diversity, reproductive traits, dispersal capacity, and trophic interactions may help evaluate whether fire regimes support ecosystem resilience and adaptive capacity. Human fire practices are also recognized as integral components of fire-regime restoration, particularly in ecosystems historically shaped by anthropogenic burning and pyrodiversity (Bird et al., 2008). Integrating ecological processes, climate adaptation, and socio-ecological values will be therefore essential for developing adaptive and context-dependent restoration strategies.

In this line, several rewilding actions can contribute to restoring ecologically functional fire regimes by influencing fuel availability, fuel dryness, ignition dynamics, and suppression patterns (Figure 14). Restoring herbivory through grazers and browsers may reduce fuel accumulation, vegetation continuity, and wildfire intensity, particularly in abandoned or fuel-accumulating landscapes (Johnson et al., 2018). Reintroducing ecosystem engineers, carnivores, or specific plant assemblages may further modify hydrology, vegetation structure, and trophic interactions affecting fire dynamics. Hydrological restoration through wetland recovery or river restoration may reduce fuel dryness and alter local fire behaviour, while adaptive ignition management and diverse burning practices can restore heterogeneous disturbance mosaics and reduce the likelihood of severe wildfires. In some fire-prone ecosystems, reducing suppression intensity and allowing naturally ignited fires to burn under controlled conditions may recover ecological processes and increase landscape heterogeneity (Stephens et al., 2013). However, the effectiveness and appropriateness of these actions depend strongly on ecosystem type, disturbance history, climatic conditions, and socio-ecological context. Rewilding therefore requires adaptive and context-specific management approaches rather than passive non-intervention alone

Aside from identifying fire switches that can be influenced by rewilding, the framework we propose to restore fire regimes through rewilding include several consecutive actions (Figure 15). Firstly, it will be necessary to characterize the ecological processes and abiotic dependencies that sustain the functioning of the targeted ecosystem, including trophic complexity, dispersal, and stochastic disturbance dynamics. Secondly, altered and target fire regimes can subsequently be identified together with the fire switches requiring intervention. Context-specific rewilding actions should then be selected to restore ecological processes while accounting for local socio-ecological conditions, disturbance histories, and climate trajectories. Finally, restoration outcomes should be monitored and adaptively evaluated to support evidence-based management and facilitate responses to ongoing environmental change. The proposed framework emphasizes flexible and adaptive restoration pathways able of integrating biodiversity conservation, disturbance regulation, ecosystem functioning, and socio-ecological resilience across a wide diversity of ecosystem types. Such an approach recognizes that future fire regimes will likely differ from historical ones and that restoration strategies must therefore account for ecological novelty and uncertainty under climate change.

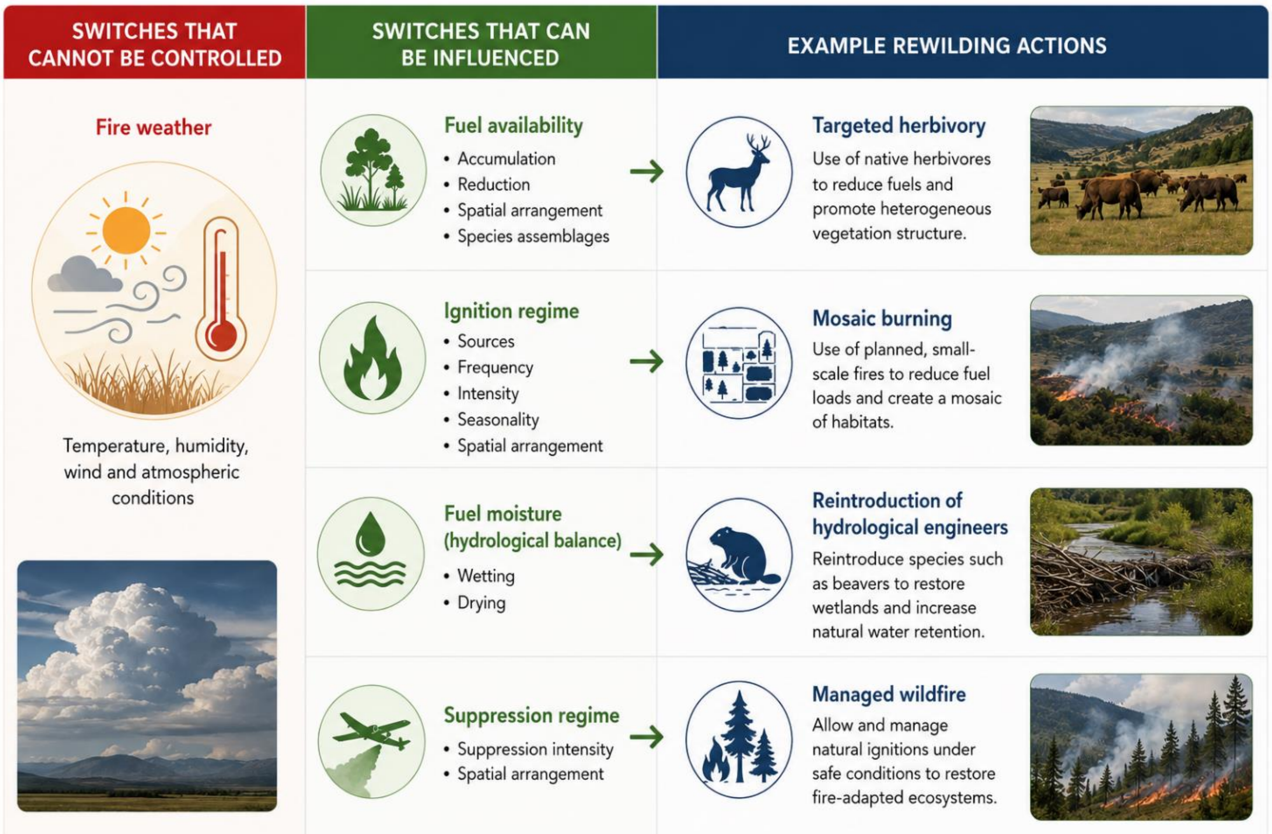


Figure 14. Possible rewilding actions for restoring fire regimes. The figure illustrates fire switches that cannot be influenced by rewilding, fire switches that can be influenced and the type of influential rewilding actions. Modified from Plumanns-Pouton et al. (2025).

3.2.4 Challenges and opportunities for rewilding fire regimes

Climate change is altering fire weather, vegetation moisture, species responses, and disturbance interactions, potentially shifting ecosystems beyond historical fire conditions and limiting the effectiveness of restoration interventions (IPCC, 2021). Fire also interacts with multiple disturbances, including droughts, pests, storms, and invasive species, generating complex ecological feedbacks that remain insufficiently understood. At the same time, wildfire poses direct risks to human lives, infrastructures and assets, and land uses, potentially generating strong social resistance to rewilding strategies involving increased fire use or reduced suppression near populated areas. Participatory governance, adaptive monitoring, and evidence-based decision-making are therefore essential to improve the social acceptability and ecological effectiveness of rewilding interventions to restore wildfire regimes.

Despite these challenges, restoring fire regimes through rewilding offers important opportunities to recover ecological processes, increase biodiversity, enhance landscape heterogeneity, and strengthen resilience in increasingly novel socio-ecological systems. Continued empirical research, long-term monitoring, and testing of rewilding interventions across different ecosystems will be essential for developing robust and adaptive approaches to wildfire-regime restoration under global change. Rewilding opportunities will be stronger when interventions are designed as temporary or spatially targeted adjustments that restore ecological processes while reducing vulnerability to more extreme future fire regimes.

Research outputs Part of the results included in this section have been already published in a scientific journal

Plumanns-Pouton, E., Bakx, T. R., Buitenwerf, R., Espelta, J. M., Moreira, F., Regos, A., Selwyn, M., & Brotons, L. (2025). Restoring fire regimes through rewilding. Current Biology, 35(13), R670-R686.

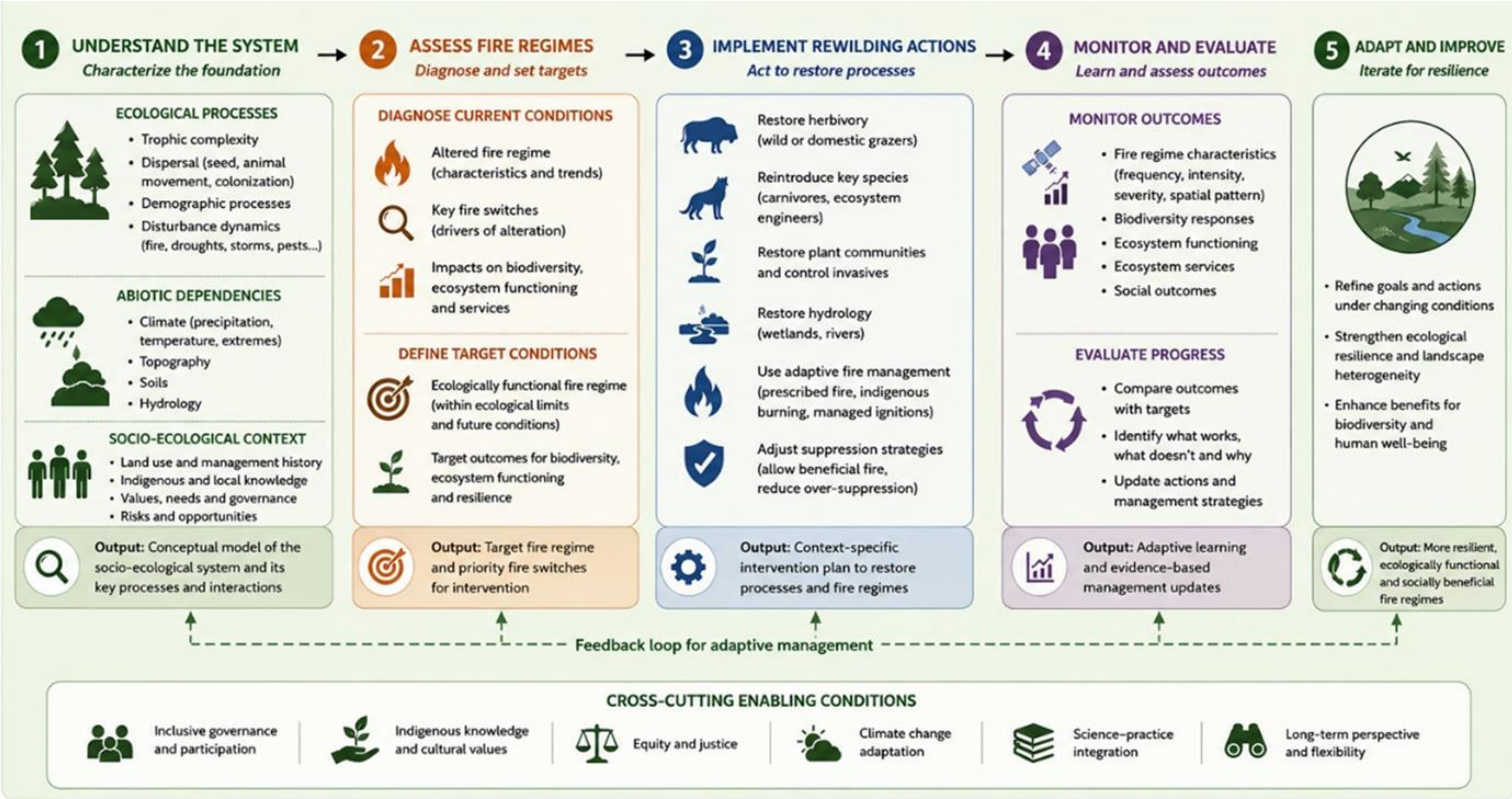


Figure 15. Sequential actions necessary for restoring wildfire regimes through rewilding based on: understanding the system, assessing fire regimes, implementing rewilding actions, monitoring and evaluations and adapting and improving the process. Modified from Plumanns-Pouton et al. (2025)

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ANNEX 1

Table 1. List of the 42 primary studies used to assess the effects of rewilding on ecosystem resilience and the most relevant information extracted (i.e., rewilding component, rewilding interventions, disturbance agent, disturbance type, resilience approach, resilience dimension, vote counting effect, system variable and system variable categorization - SV category, for more information see the glossary of terms in Supplement 2). When more than one rewilding intervention was conducted, they were all recorded and considered (i.e., Intervention 1; Intervention 2). Rewilding interventions are represented by the following abbreviations: AI = animal introduction; AR = animal removal; HE = herbivory exclousure; PF = prescribed fire; PI = plant introduction; PP = plant protection; PR = invasive or non-native plant removal; and PREP = plant replacement (i.e., removal of invasive or non-native plant species and introduction of native ones); LA = land abandonment. Vote counting effects on resilience are 1 = positive (green rows), 0 = neutral (grey rows) and -1 = negative (red rows). See Sewlyn et al. (2025) for further details.

ID	Citation	Authors	Publication year	Journal	Rewilding component	Intervention 1	Intervention 2	Disturbance agent	Disturbance type	Resilience approach	Resilience dimension	Vote counting effect	System variable	SV category
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive height	Disturbance
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive canopy	Disturbance
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive number of flowers	Disturbance
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive number of fruits	Disturbance
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive seedling recruitment	Disturbance
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive Survival	Disturbance
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive plant density	Disturbance
1	Trophic rewilding revives biotic resistance to shrub invasion	Guyton et al.	2020	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive biomass	Disturbance
2	Ecosystemic resilience of a temperate post-fire forest under extreme weather conditions	Blumroeder et al.	2022	Frontiers in Forests and Global Change	Trophic	PREP	NA	Abiotic	Episodic	Socio-ecological	Resilience	-1	Plant density	Demography
2	Ecosystemic resilience of a temperate post-fire forest under extreme weather conditions	Blumroeder et al.	2022	Frontiers in Forests and Global Change	Trophic	PREP	NA	Abiotic	Episodic	Socio-ecological	Resilience	1	Plant diversity	Biodiversity
2	Ecosystemic resilience of a temperate post-fire forest under extreme weather conditions	Blumroeder et al.	2022	Frontiers in Forests and Global Change	Trophic	PREP	NA	Abiotic	Episodic	Socio-ecological	Resilience	1	Survival	Demography
2	Ecosystemic resilience of a temperate post-fire	Blumroeder et al.	2022	Frontiers in Forests and	Trophic	PR	NA	Abiotic	Episodic	Socio-ecological	Resilience	-1	Plant density	Demography

	forest under extreme weather conditions			Global Change										
2	Ecosystemic resilience of a temperate post-fire forest under extreme weather conditions	Blumroeder et al.	2022	Frontiers in Forests and Global Change	Trophic	PR	NA	Abiotic	Episodic	Socio-ecological	Resilience	1	Plant diversity	Biodiversity
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Disturbance	PF	NA	Biotic	Episodic	Engineering	Resilience	1	Survival	Demography
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Disturbance	PF	NA	Biotic	Episodic	Engineering	Resilience	1	Basal area	Biophysical
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Disturbance	PF	NA	Biotic	Episodic	Engineering	Resilience	1	Invasive basal area	Disturbance
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Disturbance	PF	NA	Biotic	Episodic	Engineering	Resilience	1	Plant density	Demography
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Disturbance	PF	NA	Biotic	Episodic	Engineering	Resilience	1	Invasive plant density	Disturbance
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic	PR	NA	Biotic	Episodic	Engineering	Resilience	1	Survival	Demography
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic	PR	NA	Biotic	Episodic	Engineering	Resilience	1	Basal area	Biophysical
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic	PR	NA	Biotic	Episodic	Engineering	Resilience	1	Invasive basal area	Disturbance
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic	PR	NA	Biotic	Episodic	Engineering	Resilience	1	Plant density	Demography
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic	PR	NA	Biotic	Episodic	Engineering	Resilience	1	Invasive plant density	Disturbance
3	Fortifying the forest: thinning and burning	Hood et al.	2016	Ecological Applications	Trophic/disturbance	PF	PR	Biotic	Episodic	Engineering	Resilience	1	Survival	Demography

	increase resistance to a bark beetle outbreak and promote forest resilience													
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic/disturbance	PF	PR	Biotic	Episodic	Engineering	Resilience	1	Basal area	Biophysical
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic/disturbance	PF	PR	Biotic	Episodic	Engineering	Resilience	1	Invasive basal area	Disturbance
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic/disturbance	PF	PR	Biotic	Episodic	Engineering	Resilience	-1	Plant density	Demography
3	Fortifying the forest: thinning and burning increase resistance to a bark beetle outbreak and promote forest resilience	Hood et al.	2016	Ecological Applications	Trophic/disturbance	PF	PR	Biotic	Episodic	Engineering	Resilience	1	Invasive plant density	Disturbance
4	Historical and current fire regimes in ponderosa pine forests at Zion National Park, Utah: Restoration of pattern and process after a century of fire exclusion	Brown et al.	2019	Forest Ecology and Management	Disturbance	PF	NA	Abiotic	Recurrent	Ecological	Resilience	1	Fuel load	Disturbance
4	Historical and current fire regimes in ponderosa pine forests at Zion National Park, Utah: Restoration of pattern and process after a century of fire exclusion	Brown et al.	2019	Forest Ecology and Management	Disturbance	PF	NA	Abiotic	Recurrent	Ecological	Resilience	1	Fuel load	Disturbance
4	Historical and current fire regimes in ponderosa pine forests at Zion National Park, Utah: Restoration of pattern and process after a century of fire exclusion	Brown et al.	2019	Forest Ecology and Management	Disturbance	PF	NA	Abiotic	Recurrent	Ecological	Resilience	1	Fuel load	Disturbance
4	Historical and current fire regimes in ponderosa pine forests at Zion National Park, Utah: Restoration of pattern and process after a century of fire exclusion	Brown et al.	2019	Forest Ecology and Management	Disturbance	PF	NA	Abiotic	Recurrent	Ecological	Resilience	1	Canopy height	Biophysical
4	Historical and current fire regimes in ponderosa pine forests at Zion National Park, Utah: Restoration of pattern and process after a century of fire exclusion	Brown et al.	2019	Forest Ecology and Management	Disturbance	PF	NA	Abiotic	Recurrent	Ecological	Resilience	1	Fire likelihood	Disturbance

5	After long-term decline, are aspen recovering in northern Yellowstone?	Painter et al.	2014	Forest Ecology and Management	Trophic	AI	NA	Biotic	Gradual	Engineering	Recovery	1	Browsing	Disturbance
5	After long-term decline, are aspen recovering in northern Yellowstone?	Painter et al.	2014	Forest Ecology and Management	Trophic	AI	NA	Biotic	Gradual	Engineering	Recovery	1	Tree height	Biophysical
5	After long-term decline, are aspen recovering in northern Yellowstone?	Painter et al.	2014	Forest Ecology and Management	Trophic	AI	NA	Biotic	Gradual	Engineering	Recovery	1	Tree growth	Demography
6	Reintroducing Guanaco in the Upper Belt of Central Argentina: Using Population Viability Analysis to Evaluate Extinction Risk and Management Priorities	Rafael Barri	2016	Plos One	Trophic	AI	NA	Abiotic	Episodic	Ecological	Resilience	1	Survival	Demography
7	Bottom-up effect of eradications: The unintended consequences for top-order predators when eradicating invasive prey	Travers et al.	2020	Journal of Applied Ecology	Trophic	AR	NA	Biotic	Episodic	Engineering	Resilience	-1	Animal density	Demography
7	Bottom-up effect of eradications: The unintended consequences for top-order predators when eradicating invasive prey	Travers et al.	2020	Journal of Applied Ecology	Trophic	AR	NA	Biotic	Episodic	Engineering	Resilience	-1	Animal density	Demography
8	Nucleation by isolated emergent native trees can push back the shade-intolerant invader Broussonetia papyrifera (L.) L'H acute accent er. ex Vent.	Olupot & Isabirye-Batusta	2022	Trees Forests and People	Trophic	LA	NA	Biotic	Gradual	Ecological	Resilience	1	Plant abundance	Demography
8	Nucleation by isolated emergent native trees can push back the shade-intolerant invader Broussonetia papyrifera (L.) L'H acute accent er. ex Vent.	Olupot & Isabirye-Batusta	2022	Trees Forests and People	Trophic	LA	NA	Biotic	Gradual	Ecological	Resilience	1	Invasive abundance	Disturbance
9	Do No Harm: Efficacy of a Single Herbicide Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	1	Invasive plant density	Disturbance
9	Do No Harm: Efficacy of a Single Herbicide Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	1	Invasive plant density	Disturbance
9	Do No Harm: Efficacy of a Single Herbicide Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	1	Invasive plant density	Disturbance
9	Do No Harm: Efficacy of a Single Herbicide	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	1	Invasive plant density	Disturbance

	Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species													
9	Do No Harm: Efficacy of a Single Herbicide Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	1	Invasive plant density	Disturbance
9	Do No Harm: Efficacy of a Single Herbicide Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	1	Plant diversity	Biodiversity
9	Do No Harm: Efficacy of a Single Herbicide Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	1	Plant diversity	Biodiversity
9	Do No Harm: Efficacy of a Single Herbicide Application to Control an Invasive Shrub While Minimizing Collateral Damage to Native Species	Gibson et al.	2019	Plants-Basel	Trophic	PREP	NA	Biotic	Episodic	Ecological	Resistance	0	Plant diversity	Biodiversity
10	Wild herbivores enhance resistance to invasion by exotic cacti in an African savanna	Wells et al.	2022	Journal of Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive plant density	Disturbance
10	Wild herbivores enhance resistance to invasion by exotic cacti in an African savanna	Wells et al.	2022	Journal of Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	-1	Invasive plant density	Disturbance
10	Wild herbivores enhance resistance to invasion by exotic cacti in an African savanna	Wells et al.	2022	Journal of Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Invasive plant density	Disturbance
11	Short-term response and recovery of bluebells (Hyacinthoides non-scripta) after rooting by wild boar (Sus scrofa)	Sims et al.	2014	Plant Ecology	Trophic/disturbance	AI	NA	Biotic	Episodic	Ecological	Recovery	-1	Plant density	Demography
11	Short-term response and recovery of bluebells (Hyacinthoides non-scripta) after rooting by wild boar (Sus scrofa)	Sims et al.	2014	Plant Ecology	Trophic/disturbance	AI	NA	Biotic	Episodic	Ecological	Recovery	-1	Number flowers	Demography
11	Short-term response and recovery of bluebells (Hyacinthoides non-scripta) after rooting by wild boar (Sus scrofa)	Sims et al.	2014	Plant Ecology	Trophic/disturbance	AI	NA	Biotic	Episodic	Ecological	Recovery	1	Number seeds	Demography
11	Short-term response and recovery of bluebells (Hyacinthoides non-scripta) after rooting by wild boar (Sus scrofa)	Sims et al.	2014	Plant Ecology	Trophic/disturbance	AI	NA	Biotic	Episodic	Ecological	Recovery	1	Seedling recruitment	Demography
11	Short-term response and recovery of bluebells (Hyacinthoides non-	Sims et al.	2014	Plant Ecology	Trophic/disturbance	AI	NA	Biotic	Episodic	Ecological	Recovery	-1	Vegetation cover	Biophysical

	scripta) after rooting by wild boar (Sus scrofa)													
12	The fire regime response of a reintroduced endangered species	Lindenmayer at al.	2022	Restoration Ecology	Trophic/disturbance	AI	PF	Abiotic	Episodic	Engineering	Resilience	1	Animal abundance	Demography
12	The fire regime response of a reintroduced endangered species	Lindenmayer at al.	2022	Restoration Ecology	Trophic/disturbance	AI	PF	Abiotic	Episodic	Engineering	Resilience	1	Survival	Demography
13	Large predators and trophic cascades in terrestrial ecosystems of the western United States	Breschta & Ripple	2009	Biological Conservation	Trophic	AI	NA	Biotic	Recurrent	Engineering	Resilience	1	Tree recruitment	Demography
14	Post-Soviet shifts in grazing and fire regimes changed the functional plant community composition on the Eurasian steppe	Freitag at al.	2020	Global Change Biology	Trophic/disturbance	AI	NA	Abiotic	Recurrent	Socio-ecological	Resilience	-1	Vegetation cover	Biophysical
14	Post-Soviet shifts in grazing and fire regimes changed the functional plant community composition on the Eurasian steppe	Freitag at al.	2020	Global Change Biology	Trophic/disturbance	AI	NA	Abiotic	Recurrent	Socio-ecological	Resilience	1	Vegetation cover	Biophysical
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14	Post-Soviet shifts in grazing and fire regimes changed the functional plant community composition on the Eurasian steppe	Freitag at al.	2020	Global Change Biology	Trophic/disturbance	AI	NA	Abiotic	Recurrent	Socio-ecological	Resilience	-1	Canopy height	Biophysical
15	Predation risk can modify the foraging behaviour of frugivorous carnivores: Implications of rewilding apex predators for plant–animal mutualisms	Burgos et al.	2022	Journal of Animal Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Animal visits	Demography
15	Predation risk can modify the foraging behaviour of frugivorous carnivores: Implications of rewilding apex predators for plant–animal mutualisms	Burgos et al.	2022	Journal of Animal Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	1	Fruit removal	Demography
15	Predation risk can modify the foraging behaviour of frugivorous carnivores: Implications of rewilding apex	Burgos et al.	2022	Journal of Animal Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	-1	Animal visits	Demography

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15	Predation risk can modify the foraging behaviour of frugivorous carnivores: Implications of rewilding apex predators for plant–animal mutualisms	Burgos et al.	2022	Journal of Animal Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	-1	Fruit removal	Demography
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15	Predation risk can modify the foraging behaviour of frugivorous carnivores: Implications of rewilding apex predators for plant–animal mutualisms	Burgos et al.	2022	Journal of Animal Ecology	Trophic	AI	NA	Biotic	Gradual	Engineering	Resistance	-1	Fruit removal	Demography
16	Grazing livestock increases both vegetation and seed bank diversity in remnant and restored grasslands	Kapas et al.	2019	Journal of Vegetation Science	Trophic	AI	PR	Abiotic	Episodic	Socio-ecological	Resilience	1	Plant diversity	Biodiversity
16	Grazing livestock increases both vegetation and seed bank diversity in remnant and restored grasslands	Kapas et al.	2019	Journal of Vegetation Science	Trophic	AI	PR	Abiotic	Episodic	Socio-ecological	Resilience	1	Plant diversity	Biodiversity
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17	Forest restoration treatments increased growth and did not change Survival of ponderosa pines in severe drought, Arizona	Fule et al.	2021	Ecological Applications	Trophic/disturbance	PR	PF	Abiotic	Recurrent	Engineering	Resilience	0	Survival	Demography
17	Forest restoration treatments increased growth and did not change Survival of ponderosa pines in severe drought, Arizona	Fule et al.	2021	Ecological Applications	Trophic/disturbance	PR	PF	Abiotic	Episodic	Engineering	Resilience	1	Tree growth	Demography
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18	Nitrogen addition amplifies the nonlinear drought response of grassland productivity to extended growing-season droughts	Meng et al.	2021	Ecology	Trophic	HE	NA	Abiotic	Gradual	Ecological	Resilience	1	Soil characteristics	Biophysical
18	Nitrogen addition amplifies the nonlinear drought response of grassland productivity to extended growing-season droughts	Meng et al.	2021	Ecology	Trophic	HE	NA	Abiotic	Gradual	Ecological	Resilience	1	Plant biomass	Biophysical
18	Nitrogen addition amplifies the nonlinear drought response of grassland productivity to extended growing-season droughts	Meng et al.	2021	Ecology	Trophic	HE	NA	Abiotic	Gradual	Ecological	Resilience	1	Carbon storage	Biophysical
18	Nitrogen addition amplifies the nonlinear drought response of grassland productivity	Meng et al.	2021	Ecology	Trophic	HE	NA	Abiotic	Gradual	Ecological	Resilience	1	Carbon storage	Biophysical

	to extended growing-season droughts													
19	Fire versus grazing as tools to restore serpentine grasslands under global change	Hernandez et al.	2021	Restoration Ecology	Trophic	AI	NA	Biotic	Gradual	Ecological	Resilience	1	Plant diversity	Biodiversity
19	Fire versus grazing as tools to restore serpentine grasslands under global change	Hernandez et al.	2021	Restoration Ecology	Trophic	AI	NA	Biotic	Gradual	Ecological	Resilience	1	Invasive diversity	Disturbance
19	Fire versus grazing as tools to restore serpentine grasslands under global change	Hernandez et al.	2021	Restoration Ecology	Trophic	AI	NA	Biotic	Gradual	Ecological	Resilience	1	Vegetation cover	Biophysical
19	Fire versus grazing as tools to restore serpentine grasslands under global change	Hernandez et al.	2021	Restoration Ecology	Trophic	AI	NA	Biotic	Gradual	Ecological	Resilience	1	Invasive cover	Disturbance
20	Effectiveness and costs of invasive species control using different techniques to restore cerrado grasslands	Assis et al.	2020	Restoration Ecology	Trophic/disturbance	PF	NA	Biotic	Gradual	Ecological	Resilience	1	Invasive cover	Disturbance
20	Effectiveness and costs of invasive species control using different techniques to restore cerrado grasslands	Assis et al.	2020	Restoration Ecology	Trophic/disturbance	PF	NA	Biotic	Gradual	Ecological	Resilience	-1	Bare soil	Biophysical
20	Effectiveness and costs of invasive species control using different techniques to restore cerrado grasslands	Assis et al.	2020	Restoration Ecology	Trophic/disturbance	PF	NA	Biotic	Gradual	Ecological	Resilience	-1	Vegetation cover	Biophysical
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20	Effectiveness and costs of invasive species control using different techniques to restore cerrado grasslands	Assis et al.	2020	Restoration Ecology	Trophic	PR	NA	Biotic	Gradual	Ecological	Resilience	-1	Plant diversity	Biodiversity
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20	Effectiveness and costs of invasive species control using different techniques to restore cerrado grasslands	Assis et al.	2020	Restoration Ecology	Trophic	PR	NA	Biotic	Gradual	Ecological	Resilience	1	Plant diversity	Biodiversity
21	Pyrogenic flowering of Aristida beyrichiana following 50 years of fire exclusion	Shearman et al.	2019	Ecosphere	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	1	Plant density	Demography
21	Pyrogenic flowering of Aristida beyrichiana following 50 years of fire exclusion	Shearman et al.	2019	Ecosphere	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	1	Basal area	Biophysical
21	Pyrogenic flowering of Aristida beyrichiana following 50 years of fire exclusion	Shearman et al.	2019	Ecosphere	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	1	Number flowers	Demography
22	Assessing vegetation recovery in reclaimed opencast mines of the Teruel coalfield (Spain) using Landsat time	Vidal-Macua et al.	2020	Science of the Total Environment	Trophic	LA	NA	Abiotic	Episodic	Ecological	Recovery	1	NDVI	Biophysical

	series and boosted regression trees													
23	Abandoned pastures cannot spontaneously recover the attributes of old-growth savannas	Cava et al.	2017	Journal of Applied Ecology	Trophic	LA	NA	Biotic	Gradual	Engineering	Resilience	1	Vegetation cover	Biophysical
23	Abandoned pastures cannot spontaneously recover the attributes of old-growth savannas	Cava et al.	2017	Journal of Applied Ecology	Trophic	LA	NA	Biotic	Gradual	Engineering	Resilience	1	Bare soil	Biophysical
23	Abandoned pastures cannot spontaneously recover the attributes of old-growth savannas	Cava et al.	2017	Journal of Applied Ecology	Trophic	LA	NA	Biotic	Gradual	Engineering	Resilience	1	Vegetation cover	Biophysical
23	Abandoned pastures cannot spontaneously recover the attributes of old-growth savannas	Cava et al.	2017	Journal of Applied Ecology	Trophic	LA	NA	Biotic	Gradual	Engineering	Resilience	0	Invasive cover	Disturbance
23	Abandoned pastures cannot spontaneously recover the attributes of old-growth savannas	Cava et al.	2017	Journal of Applied Ecology	Trophic	LA	NA	Biotic	Gradual	Engineering	Resilience	1	Plant density	Demography
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23	Abandoned pastures cannot spontaneously recover the attributes of old-growth savannas	Cava et al.	2017	Journal of Applied Ecology	Trophic	LA	NA	Biotic	Gradual	Engineering	Resilience	1	Plant diversity	Biodiversity
24	Plant volatiles inhibit restoration of plant species communities in dry grassland	Tsubo et al.	2011	Basic and Applied Ecology	Trophic	AR	NA	Biotic	Gradual	Socio-ecological	Recovery	-1	Invasive height	Disturbance
24	Plant volatiles inhibit restoration of plant species communities in dry grassland	Tsubo et al.	2011	Basic and Applied Ecology	Trophic	AR	NA	Biotic	Gradual	Socio-ecological	Recovery	1	Invasive plant density	Disturbance
24	Plant volatiles inhibit restoration of plant species communities in dry grassland	Tsubo et al.	2011	Basic and Applied Ecology	Trophic	AR	NA	Biotic	Gradual	Socio-ecological	Recovery	-1	Invasive biomass	Disturbance
24	Plant volatiles inhibit restoration of plant species communities in dry grassland	Tsubo et al.	2011	Basic and Applied Ecology	Trophic	AR	NA	Biotic	Gradual	Socio-ecological	Recovery	-1	Invasive biomass	Disturbance
25	Buffel grass (Cenchrus ciliaris) eradication in arid central Australia enhances native plant diversity and increases seed resources for granivores	Wright et al.	2020	Applied Vegetation Science	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Invasive abundance	Disturbance
25	Buffel grass (Cenchrus ciliaris) eradication in arid central Australia enhances native plant diversity and increases seed resources for granivores	Wright et al.	2020	Applied Vegetation Science	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Plant abundance	Demography
25	Buffel grass (Cenchrus ciliaris) eradication in arid central Australia enhances native plant diversity and increases seed resources for granivores	Wright et al.	2020	Applied Vegetation Science	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Plant abundance	Demography

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25	Buffel grass (Cenchrus ciliaris) eradication in arid central Australia enhances native plant diversity and increases seed resources for granivores	Wright et al.	2020	Applied Vegetation Science	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Seedling recruitment	Demography
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25	Buffel grass (Cenchrus ciliaris) eradication in arid central Australia enhances native plant diversity and increases	Wright et al.	2020	Applied Vegetation Science	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Invasive biomass	Disturbance

	seed resources for granivores													
25	Buffel grass (Cenchrus ciliaris) eradication in arid central Australia enhances native plant diversity and increases seed resources for granivores	Wright et al.	2020	Applied Vegetation Science	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Plant biomass	Biophysical
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26	Ten years of pulling: Ecosystem recovery after long-term weed management in Garry oak savanna	Shackelford et al.	2019	Conservation Science and Practice	Disturbance	PR	NA	Biotic	Gradual	Ecological	Resistance	0	Area lost	Biophysical
26	Ten years of pulling: Ecosystem recovery after long-term weed management in Garry oak savanna	Shackelford et al.	2019	Conservation Science and Practice	Disturbance	PR	NA	Biotic	Gradual	Ecological	Resistance	0	Area lost	Biophysical
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26	Ten years of pulling: Ecosystem recovery after long-term weed	Shackelford et al.	2019	Conservation Science and Practice	Disturbance	PR	NA	Biotic	Gradual	Ecological	Resistance	0	Plant diversity	Biodiversity

	management in Garry oak savanna														
26	Ten years of pulling: Ecosystem recovery after long-term weed management in Garry oak savanna	Shackelford et al.	2019	Conservation Science and Practice	Disturbance	PR	NA	Biotic	Gradual	Ecological	Resistance	0	Plant diversity	Biodiversity
26	Ten years of pulling: Ecosystem recovery after long-term weed management in Garry oak savanna	Shackelford et al.	2019	Conservation Science and Practice	Disturbance	PR	NA	Biotic	Gradual	Ecological	Resistance	0	Species turnover	Biodiversity
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27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical
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27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Microbial biomass	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	-1	Microbial biomass	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical

27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	-1	Soil characteristics	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	-1	Soil characteristics	Biophysical
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27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical
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27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	-1	Soil characteristics	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Soil characteristics	Biophysical
27	Oribatid mites enhance the recovery of the microbial community after a strong disturbance	Maraun et al.	1998	Applied Soil Ecology	Trophic	AI	NA	Abiotic	Episodic	Engineering	Recovery	1	Animal diversity	Biodiversity
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	-1	Survival	Demography

28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Biotic	Episodic	Ecological	Resilience	1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
28	Biocrusts mediate the plant community composition of dryland restoration ecosystems	Song et al.	2022	Science of the Total Environment	Trophic	PI	NA	Abiotic	Episodic	Ecological	Resilience	-1	Survival	Demography
29	Small-scale barriers mitigate desertification processes and enhance plant recruitment in a degraded semiarid grassland	Fick et al.	2016	Ecosphere	Trophic/disturbance	PR	NA	Biotic	Gradual	Engineering	Resilience	1	Seedling recruitment	Demography
29	Small-scale barriers mitigate desertification processes and enhance plant recruitment in a degraded semiarid grassland	Fick et al.	2016	Ecosphere	Trophic/disturbance	PR	SD	Biotic	Gradual	Engineering	Resilience	1	Seedling recruitment	Demography

29	Small-scale barriers mitigate desertification processes and enhance plant recruitment in a degraded semiarid grassland	Fick et al.	2016	Ecosphere	Trophic/disturbance	PR	SD	Biotic	Gradual	Engineering	Resilience	1	Invasive seedling recruitment	Disturbance
29	Small-scale barriers mitigate desertification processes and enhance plant recruitment in a degraded semiarid grassland	Fick et al.	2016	Ecosphere	Trophic/disturbance	PR	NA	Biotic	Gradual	Engineering	Resilience	1	Animal abundance	Demography
29	Small-scale barriers mitigate desertification processes and enhance plant recruitment in a degraded semiarid grassland	Fick et al.	2016	Ecosphere	Trophic/disturbance	PR	SD	Biotic	Gradual	Engineering	Resilience	1	Animal abundance	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Plant-animal interactions	Biodiversity
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Dispersed seeds	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Dispersed seeds	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Dispersed seeds	Demography
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30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Dispersed seeds	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Fruit removal	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Fruit removal	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Fruit removal	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Fruit removal	Demography

30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Fruit removal	Demography
30	Excluding mammalian predators increases bird densities and seed dispersal in fenced ecosanctuaries	Bombaci et al.	2021	Ecology	Trophic	AR	NA	Biotic	Episodic	Ecological	Recovery	1	Fruit removal	Demography
31	How mowing restores montane Mediterranean grasslands following cessation of traditional livestock grazing	Tardella et al.	2020	Agriculture Ecosystems and Environment	Trophic/disturbance	PR	NA	Biotic	Gradual	Socio-ecological	Resilience	1	Invasive cover	Disturbance
31	How mowing restores montane Mediterranean grasslands following cessation of traditional livestock grazing	Tardella et al.	2020	Agriculture Ecosystems and Environment	Trophic/disturbance	PR	NA	Biotic	Gradual	Socio-ecological	Resilience	-1	Litter cover	Biophysical
31	How mowing restores montane Mediterranean grasslands following cessation of traditional livestock grazing	Tardella et al.	2020	Agriculture Ecosystems and Environment	Trophic/disturbance	PR	NA	Biotic	Gradual	Socio-ecological	Resilience	1	Plant diversity	Biodiversity
31	How mowing restores montane Mediterranean grasslands following cessation of traditional livestock grazing	Tardella et al.	2020	Agriculture Ecosystems and Environment	Trophic/disturbance	PR	NA	Biotic	Gradual	Socio-ecological	Resilience	0	Plant diversity	Biodiversity
31	How mowing restores montane Mediterranean grasslands following cessation of traditional livestock grazing	Tardella et al.	2020	Agriculture Ecosystems and Environment	Trophic/disturbance	PR	NA	Biotic	Gradual	Socio-ecological	Resilience	1	Plant diversity	Biodiversity
32	Management of invasive Pinaceae is imperiled by the lack of invasive ungulate control: successful restoration requires multiple-species management	Ballari et al.	2019	Mammal Research	Trophic	PR	AI	Biotic	Recurrent	Ecological	Resilience	1	Vegetation cover	Biophysical
32	Management of invasive Pinaceae is imperiled by the lack of invasive ungulate control: successful restoration requires multiple-species management	Ballari et al.	2019	Mammal Research	Trophic	PR	AI	Biotic	Recurrent	Ecological	Resilience	-1	Invasive cover	Disturbance
32	Management of invasive Pinaceae is imperiled by the lack of invasive ungulate control: successful restoration requires multiple-species management	Ballari et al.	2019	Mammal Research	Trophic	PR	AI	Biotic	Recurrent	Ecological	Resilience	-1	Browsing	Disturbance
32	Management of invasive Pinaceae is imperiled by the lack of invasive ungulate control: successful restoration requires multiple-species management	Ballari et al.	2019	Mammal Research	Trophic	PR	AI	Biotic	Recurrent	Ecological	Resilience	-1	Browsing	Disturbance

32	Management of invasive Pinaceae is imperiled by the lack of invasive ungulate control: successful restoration requires multiple-species management	Ballari et al.	2019	Mammal Research	Trophic	PR	AI	Biotic	Recurrent	Ecological	Resilience	1	Plant diversity	Biodiversity
32	Management of invasive Pinaceae is imperiled by the lack of invasive ungulate control: successful restoration requires multiple-species management	Ballari et al.	2019	Mammal Research	Trophic	PR	AI	Biotic	Recurrent	Ecological	Resilience	-1	Invasive diversity	Disturbance
33	Bioengineering effectiveness of seed mixtures for road verges: Functional composition as a predictor of grassland diversity and invasion resistance	Staab et al.	2015	Ecological Engineering	Trophic	PI	NA	Biotic	Gradual	Socio-ecological	Resistance	1	Vegetation cover	Biophysical
33	Bioengineering effectiveness of seed mixtures for road verges: Functional composition as a predictor of grassland diversity and invasion resistance	Staab et al.	2015	Ecological Engineering	Trophic	PI	NA	Biotic	Gradual	Socio-ecological	Resistance	-1	Vegetation cover	Biophysical
33	Bioengineering effectiveness of seed mixtures for road verges: Functional composition as a predictor of grassland diversity and invasion resistance	Staab et al.	2015	Ecological Engineering	Trophic	PI	NA	Biotic	Gradual	Socio-ecological	Resistance	1	Invasive seedling recruitment	Disturbance
33	Bioengineering effectiveness of seed mixtures for road verges: Functional composition as a predictor of grassland diversity and invasion resistance	Staab et al.	2015	Ecological Engineering	Trophic	PI	NA	Biotic	Gradual	Socio-ecological	Resistance	1	Invasive seedling recruitment	Disturbance
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33	Bioengineering effectiveness of seed mixtures for road verges: Functional composition as a predictor of grassland diversity and invasion resistance	Staab et al.	2015	Ecological Engineering	Trophic	PI	NA	Biotic	Gradual	Socio-ecological	Resistance	1	Invasive seedling recruitment	Disturbance
33	Bioengineering effectiveness of seed mixtures for road verges: Functional composition as a	Staab et al.	2015	Ecological Engineering	Trophic	PI	NA	Biotic	Gradual	Socio-ecological	Resistance	1	Invasive seedling recruitment	Disturbance

	predictor of grassland diversity and invasion resistance													
33	Bioengineering effectiveness of seed mixtures for road verges: Functional composition as a predictor of grassland diversity and invasion resistance	Staab et al.	2015	Ecological Engineering	Trophic	PI	NA	Biotic	Gradual	Socio-ecological	Resistance	1	Invasive seedling recruitment	Disturbance
34	Effects of modifying soil microbes on restoring vegetation degraded by an invasive plant crofton weed (Ageratina adenophora)	Chen et al.	2020	Applied Ecology and Environmental Research	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Invasive biomass	Disturbance
34	Effects of modifying soil microbes on restoring vegetation degraded by an invasive plant crofton weed (Ageratina adenophora)	Chen et al.	2020	Applied Ecology and Environmental Research	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Invasive biomass	Disturbance
34	Effects of modifying soil microbes on restoring vegetation degraded by an invasive plant crofton weed (Ageratina adenophora)	Chen et al.	2020	Applied Ecology and Environmental Research	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	1	Invasive biomass	Disturbance
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34	Effects of modifying soil microbes on restoring vegetation degraded by an invasive plant crofton weed (Ageratina adenophora)	Chen et al.	2020	Applied Ecology and Environmental Research	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	0	Plant biomass	Biophysical
34	Effects of modifying soil microbes on restoring vegetation degraded by an invasive plant crofton weed (Ageratina adenophora)	Chen et al.	2020	Applied Ecology and Environmental Research	Trophic	PR	NA	Biotic	Gradual	Ecological	Resistance	0	Plant biomass	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	1	Fuel load	Disturbance

	achieving success in the Sierra Nevada													
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	1	Fuel load	Disturbance
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	0	Fuel load	Disturbance
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	1	Fuel load	Disturbance
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	1	Fuel load	Disturbance
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	1	Fuel load	Disturbance
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	1	Fuel load	Disturbance
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	PR	Abiotic	Episodic	Engineering	Resilience	1	Carbon storage	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	0	Basal area	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	-1	Plant density	Demography
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	0	Density dead trees	Demography
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	0	Vegetation cover	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	-1	Plant abundance	Demography
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	-1	Litter cover	Biophysical

35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	-1	Plant density	Demography
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PF	NA	Abiotic	Episodic	Engineering	Resilience	1	Carbon storage	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PR	NA	Abiotic	Episodic	Engineering	Resilience	0	Basal area	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PR	NA	Abiotic	Episodic	Engineering	Resilience	-1	Plant density	Demography
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35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PR	NA	Abiotic	Episodic	Engineering	Resilience	0	Vegetation cover	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PR	NA	Abiotic	Episodic	Engineering	Resilience	0	Plant abundance	Demography
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PR	NA	Abiotic	Episodic	Engineering	Resilience	0	Litter cover	Biophysical
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PR	NA	Abiotic	Episodic	Engineering	Resilience	-1	Plant density	Demography
35	Forest restoration and fuels reduction work: Different pathways for achieving success in the Sierra Nevada	Stephens et al.	2023	Ecological Applications	Disturbance	PR	NA	Abiotic	Episodic	Engineering	Resilience	1	Carbon storage	Biophysical
36	A Physiological and Molecular Focus on the Resistance of "Filippo Ceo" Almond Tree to Xylella fastidiosa	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Biotic	Recurrent	Socio-ecological	Resistance	-1	Water content	Biophysical
36	A Physiological and Molecular Focus on the Resistance of "Filippo Ceo" Almond Tree to Xylella fastidiosa	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Biotic	Recurrent	Socio-ecological	Resistance	1	Drought tolerance	Demography
36	A Physiological and Molecular Focus on the Resistance of "Filippo Ceo" Almond Tree to Xylella fastidiosa	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Abiotic	Recurrent	Socio-ecological	Resistance	-1	Water content	Biophysical
36	A Physiological and Molecular Focus on the Resistance of "Filippo	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Abiotic	Recurrent	Socio-ecological	Resistance	1	Drought tolerance	Demography

	Ceo" Almond Tree to Xylella fastidiosa													
36	A Physiological and Molecular Focus on the Resistance of "Filippo Ceo" Almond Tree to Xylella fastidiosa	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Abiotic	Recurrent	Socio-ecological	Resistance	-1	Water content	Biophysical
36	A Physiological and Molecular Focus on the Resistance of "Filippo Ceo" Almond Tree to Xylella fastidiosa	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Abiotic	Recurrent	Socio-ecological	Resistance	1	Drought tolerance	Demography
36	A Physiological and Molecular Focus on the Resistance of "Filippo Ceo" Almond Tree to Xylella fastidiosa	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Biotic	Recurrent	Socio-ecological	Resistance	-1	Water content	Biophysical
36	A Physiological and Molecular Focus on the Resistance of "Filippo Ceo" Almond Tree to Xylella fastidiosa	De Pascali et al.	2024	Plants-Basel	Trophic	PI	NA	Biotic	Recurrent	Socio-ecological	Resistance	1	Drought tolerance	Demography
37	Incorporation of Indaziflam into Natural Areas Management of Cheatgrass and Other Short-Lived Invasive Species: Post-Fire Assessment in a Semi-Arid Colorado Grasslands	Alba et al.	2024	BioOne	Trophic	PR	NA	Abiotic	Episodic	Engineering	Resilience	-1	Invasive cover	Disturbance
37	Incorporation of Indaziflam into Natural Areas Management of Cheatgrass and Other Short-Lived Invasive Species: Post-Fire Assessment in a Semi-Arid Colorado Grasslands	Alba et al.	2024	BioOne	Trophic	PR	NA	Abiotic	Episodic	Engineering	Resilience	-1	Invasive cover	Disturbance
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37	Incorporation of Indaziflam into Natural Areas Management of Cheatgrass and Other Short-Lived Invasive Species: Post-Fire Assessment in a Semi-Arid Colorado Grasslands	Alba et al.	2024	BioOne	Trophic	PR	NA	Abiotic	Episodic	Engineering	Resilience	1	Plant diversity	Biodiversity

38	Functional consequences of animal community changes in managed grasslands: An application of the CAFE approach	Hogan et al.	2023	Ecology	Trophic	AI	NA	Abiotic	Recurrent	Engineering	Resilience	0	Animal density	Demography
38	Functional consequences of animal community changes in managed grasslands: An application of the CAFE approach	Hogan et al.	2023	Ecology	Trophic	AI	NA	Abiotic	Recurrent	Engineering	Resilience	1	Animal density	Demography
39	Megaherbivores provide biotic resistance against alien plant dominance	Mungi et al.	2023	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resilience	1	Vegetation cover	Biophysical
39	Megaherbivores provide biotic resistance against alien plant dominance	Mungi et al.	2023	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resilience	1	Invasive cover	Disturbance
39	Megaherbivores provide biotic resistance against alien plant dominance	Mungi et al.	2023	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resilience	1	Plant diversity	Biodiversity
39	Megaherbivores provide biotic resistance against alien plant dominance	Mungi et al.	2023	Nature Ecology & Evolution	Trophic	AI	NA	Biotic	Gradual	Engineering	Resilience	1	Invasive diversity	Disturbance
40	Recolonizing native wildlife facilitates exotic plant invasion into Singapore's rain forests	Ho et al.	2023	bioTropica	Trophic	AI	NA	Biotic	Gradual	Ecological	Resistance	1	Invasive plant density	Disturbance
40	Recolonizing native wildlife facilitates exotic plant invasion into Singapore's rain forests	Ho et al.	2023	bioTropica	Trophic	AI	NA	Biotic	Gradual	Ecological	Resistance	1	Invasive plant density	Disturbance
41	Experimental downed woody debris-created microsites enhance tree Survival and growth in extreme summer heat	Swanson et al.	2023	Frontiers in Forests and Global Change	Trophic	PP	NA	Abiotic	Recurrent	Ecological	Resistance	1	Survival	Demography
41	Experimental downed woody debris-created microsites enhance tree Survival and growth in extreme summer heat	Swanson et al.	2023	Frontiers in Forests and Global Change	Trophic	PP	NA	Abiotic	Recurrent	Ecological	Resistance	1	Survival	Demography
41	Experimental downed woody debris-created microsites enhance tree Survival and growth in extreme summer heat	Swanson et al.	2023	Frontiers in Forests and Global Change	Trophic	PP	NA	Abiotic	Recurrent	Ecological	Resistance	1	Survival	Demography
41	Experimental downed woody debris-created microsites enhance tree Survival and growth in extreme summer heat	Swanson et al.	2023	Frontiers in Forests and Global Change	Trophic	PP	NA	Abiotic	Recurrent	Ecological	Resistance	1	Survival	Demography
42	Ecological Restoration in Eastern Canada Using Four Early Successional Species on Severely Degraded Sites Using a Factorial of Site-Preparation Treatments: Growth and Biomass over Two Years	Galea et al.	2024	Forests	Trophic	PI	PP	Abiotic	Recurrent	Ecological	Resistance	1	Soil characteristics	Biophysical

42	Ecological Restoration in Eastern Canada Using Four EarlySuccessional Species on Severely Degraded Sites Using a Factorial of Site-Preparation Treatments: Growth and Biomass over Two Years	Galea et al.	2024	Forests	Trophic	PI	PP	Abiotic	Recurrent	Ecological	Resistance	1	Tree growth	Demography
42	Ecological Restoration in Eastern Canada Using Four Early Successional Species on Severely Degraded Sites Using a Factorial of Site-Preparation Treatments: Growth and Biomass over Two Years	Galea et al.	2024	Forests	Trophic	PI	PP	Abiotic	Recurrent	Ecological	Resistance	1	Water content	Biophysical
42	Ecological Restoration in Eastern Canada Using Four Early Successional Species on Severely Degraded Sites Using a Factorial of Site-Preparation Treatments: Growth and Biomass over Two Years	Galea et al.	2024	Forests	Trophic	PI	PP	Abiotic	Recurrent	Ecological	Resistance	1	Water content	Biophysical
42	Ecological Restoration in Eastern Canada Using Four Early Successional Species on Severely Degraded Sites Using a Factorial of Site-Preparation Treatments: Growth and Biomass over Two Years	Galea et al.	2024	Forests	Trophic	PI	PP	Abiotic	Recurrent	Ecological	Resistance	1	Water content	Biophysical

ANNEX 2

Annex 2: List of articles used in the analyses of direction of disturbance change after rewilding. Direction of disturbance is indicated by the color of the article: red = increase, green = decrease, gray = neutral, black = article not included.

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ANNEX 3

WORKSHOP - REWILDING IN THE CONTEXT OF INCREASING DISTURBANCES

DAY 1 WEDNESDAY 11TH MARCH

Morning session
Session 1: Harnessing disturbances to promote rewilding

- **9:00** Introduction to the workshop and to the session
- **9:10** *Turning disturbance into opportunity: harnessing natural tree regeneration to promote forest resilience.* Arndt Hampe (INRAE)
- **9:20** *Post bark beetle (Ips typographus) recovery of natural and managed forests: an opportunity to increase forest resilience to climate change and biodiversity potential.* Miroslav Svoboda (Czech University of Life Sciences)
- **9:30** *Drought-induced die-off as a catalyst for forest reorganization: Compositional shifts, regeneration filtering, and habitat provision in P. sylvestris forests.* Faqrul Chowdhury. (Autonomous University of Barcelona)
- **9:40** *Restoring disturbance through trophic rewilding - implications for European plant diversity.* Robert Buitenwerf (Aarhus University)
- **9:50** Burning questions on presentations

10:00 Break

- **10:15** General Discussion Session 1

12:15 Lunch break

Afternoon session
Session 2: The role of rewilding on influencing disturbances

- **14:00** Introduction to the session
- **14:05** *Assessing the effect of time since abandonment on the drought resistance, recovery, and resilience of unmanaged forests in Europe.* Antonio Tomao / Viktor Schröder (University of Udine)
- **14:15** *Landscape case studies in WILDCARD and their relationship to disturbances.* Carmen Steinmann (ETH Zurich)
- **14:25** *Drought-driven forest dieback in naturally expanding forests: challenges and opportunities.* Josep Maria Espelta (CREAF)
- **14:35** *Two sides of disturbances in forests from a rewilding perspective.* Georg Winkel (Wageningen University)
- **14:45** Burning questions on presentations

14:55 Break

- **15:10** General Discussion Session 2
- **17:00** End of the session

DAY 2 THURSDAY 12TH MARCH

Session 3: On the rewilding & wildfires nexus

- **9:00** Introduction to the session
- **9:05** *What is the role of fire in rewilding? Synthesizing peer-reviewed literature into four thematic discourses.* Francisco Navarro Rosales (IRD)
- **9:15** Restoring fire regimes through rewilding. Ella Plumanns-Pouton (CREAF)
- **9:25** *Managing fire ignition and suppression in rewilded areas in Europe.* Francisco Moreira / Pedro Beja (CIBIO, Portugal)
- **9:35** *Using fire to enhance rewilding under rural abandonment: a nature-based pathway towards fire-smart landscapes.* Adrián Regos (CSIC)
- **9:45** *Rewilding policies for carbon sequestration under increasing fire risk – REWILD-FIRE project.* Giorgio Vachiano (University degli Studi di Milano)
- **9:55** *Integrating rewilding into wildfire risk management: synergies and trade-offs.* Davide Ascoli (University of Torino)
- **10:05** Burning questions on presentations

10:15 Coffee break

- **10:30** General Discussion Session 3
- **12:30** Next steps
- **12:40** End of workshop

wildE WILD CARD REWILDFIRE

ANNEX 4

PARTICIPANTS

NAME	SURNAME	INSTITUTION
Lydwin	Wagenaar	WildE
Jemma	Simpson	WildE
Tristan	Bakx	WildE
Davide	Ascoli	Rewildfire
Faqrul Islam	CHOWDHURY	WildE
Lluis	Brotons	WildE
Ricardo	Ceia	WildE
Arndt	Hampe	WildE
giorgio	vacchiano	Rewildfire
Beatrice	Petti	WildE
Fred	Rainsford	Rewildfire
Anna	Ferretto	WildE
Antonio	Tomao	WildCard
Francisco	Moreira	WildE
Marcus	Lindner	WildCard
Adrián	Regos	WildE
Susana	Silvestre Carbonell	WildE
Imma	Oliveras Menor	WildE
Francisco	Navarro-Rosales	Rewildfire
Liesbeth	Bakker	WildE
Nacho	Villar	WildE
Joana	Santana	WildE
Viktor	Schröder	WildCard
Giorgio	Alberti	WildCard
Robert	Buitenwerf	WildE
Carmen	Steinmann	WildCard
Georg	Winkel	WildE
Carmen	Rodriguez Fernandez Blanco	WildCard
Ella	Plumanns	WildE
Josep Maria	Espelta	WildE
Arnau	Tolrà Montero	Rewildfire
Elisabeth	Klingberg	WildCard
Gian Luca	Spadoni	Rewildfire
Alba	Gimbert Álvarez	Communication team CREAF

ANNEX 5

Annex 5. List of references used for Table 3 on the main potential risk factors and potential negative effects after rewilding on increasing disturbances and how to reverse them.

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