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RE-NEW OPINION ARTICLE

Applying conventional funding mechanisms to rewilding: the opportunities and challenges for funding rewilding in Europe

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As we progress through the United Nations' "Decade of Restoration", we face the challenge of identifying and developing restoration funding mechanisms for two reasons. First, given past failures at the global level to meet restoration goals, funding mechanisms are needed that allow for scaling up restoration efforts. Second, restoration approaches are changing, with an increasing focus on functional and dynamic restoration goals. Rewilding is an emerging ecological restoration strategy that addresses both of these challenges by restoring self-sustaining complex ecosystems characterized by minimal human interference. As of yet there has been little attention paid to rewilding in the discussion around restoration funding. We suggest that rewilding offers a promising avenue for restoration funding in Europe. However, the unique characteristics of rewilding may also lead to challenges when attempting to tap into existing funding streams, which may need to be modified to better suit rewilding special needs.

Key words: conservation, conservation finance mechanisms, rewilding

Implications for Practice

- If we are to meet global restoration goals and upscale rewilding, we need to develop new market-based funding mechanisms, alongside maintaining and adapting non-market funding flows.
- While rewilding as a restoration technique can look different depending on the geographical context, the recommendations from this study are still applicable to rewilding at the global scale. For example, proven rewilding-based business models in Europe may be adapted to promote rewilding further afield. In addition, restoration projects outside Europe can access new funding sources (such as rewilding-inclined philanthropists), by promoting rewilding outcomes.

Introduction

Rewilding is an emerging paradigm in restoration science. It has been highlighted as a key mechanism to overcome the global biodiversity crisis and increase the resilience of the biosphere to man-made climate change (Svenning 2020). Existing on a spectrum of scale, connectivity, and level of human input (Carver et al. 2021), the precise definition of rewilding in the literature has varied (Gammon 2018). Here, we define rewilding as the process of allowing, or facilitating, the restoration of self-sustaining, complex ecosystems that eventually require no or minimum-intervention management (Perino et al. 2019). In practice, this can range from "trophic" rewilding (Svenning et al. 2016) of megafauna to restore top-down trophic cascades, to passive rewilding, which emphasizes the immediate reduction of human control of an ecosystem, allowing natural regeneration (Pereira & Navarro 2015).

Rewilding is a subset of ecological restoration, offering an alternative strategy to other restoration approaches. Many restoration techniques require managing ecosystems on a trajectory toward a desired end state, followed by continued maintenance to conserve a target species or habitat (Corlett 2016). In rewilding there is no pre-defined target for how the landscape should look (Pereira & Navarro 2015). Therefore, consistent production of a commodity, or certifying credits, is more difficult. Given these

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differences, we argue that the ways in which rewilding can be funded will differ from alternative restoration approaches.

While rewilding may have upfront costs (Carver 2019) the goal is to have minimal management over time. Rewilding—particularly passive rewilding on abandoned land—appears to offer a cost-effective solution for funding restoration when compared with active restoration techniques (Carver 2019; Schou et al. 2021). However, as the end ecosystem state is neither prescribed, nor managed for, the resulting ecosystem is dynamic and can take a long time to reach. In addition, rewilding is not a socially, or economically, desirable restoration strategy in every context. For example, land critical for local food production is unlikely to be suitable for rewilding.

In Europe, rewilding-specific NGOs such as Rewilding Europe and Rewilding Britain are promoting rewilding as an important restoration approach and have been able to tap into multiple funding sources, including private donations and charitable grants. Furthermore, major research funding programs such as the Horizon program have included rewilding in their calls. Thus, Europe provides a compelling case study for our discussion of rewilding funding.

Opportunities and Challenges for Funding Rewilding

Restoration may be funded by a wide range of nonmarket and market-based mechanisms (Table 1). Typically, nonmarket mechanisms involve nonrepayable "donations" of capital, while market-based mechanisms rely on something tangible being delivered in response to investment. We discuss the ways in which these funding mechanisms could work for rewilding in Europe, highlighting unique opportunities and challenges (Table 2).

The discussion takes place against the backdrop of a global funding gap for conservation (Barbier et al. 2018). The majority of global conservation funding comes from nonmarket mechanisms, which has remained static or declining over time with respect to the proportion of the budget it occupies (Deutz et al. 2020). At the same time, although market-based mechanisms have been hailed as a potential solution (Deutz et al. 2020), their ability to bridge the funding gap has been questioned (Dempsey & Suarez 2016). With the emergence of new restoration strategies, the potential of these mechanisms to bridge the funding gap should be revisited.

Nonmarket Mechanisms

Domestic Budget Allocation. Domestic budget allocation typically involves a single, or repeated, "donation" of capital over time to conservation (Table 1). Estimated at over 80% of current conservation funding (Deutz et al. 2020), rewilding funding could be increased through a greater designation of governmental budgets (Table 2). However, this is a political decision and must be considered against competition from other sectors.

Donations. Rewilding is popular across a range of stakeholder groups (Loth & Newton 2018) and offers potential to leverage funding from private donors. The super-wealthy can finance large-scale rewilding projects, while concerned citizens may turn to crowdfunding platforms. For example, the philanthropic foundation Aage V. Jensens Naturfond acquire land to implement restoration and rewilding in Denmark, while the wealthy Polvsen family have acquired over 200,000 ha for rewilding in the Scottish Highlands (Carrell 2019). As pressure is placed on the super-wealthy to help solve the global climate and biodiversity crisis, more rewilding projects may be financed in the future. However, without proper consultation, there exists the risk of marginalizing the views of local people, leading to undesirable economic and social outcomes.

Subsidies. Agri-environmental subsidies, such as Europe's Common Agricultural Policy (CAP), target conservation and restoration on agricultural land (Table 1). However, the green credentials of the CAP have been challenged (e.g., Pe'er et al. 2019). Perceived to promote ubiquitous agricultural use of landscapes, a reimagining of the CAP could provide biodiversity benefits by promoting rewilding (Merckx & Pereira 2015). As agricultural landscapes become abandoned (Van der Zanden et al. 2017), subsidies could be modified to compensate land owners based on the area abandoned, or through financing rewilding interventions. This would align with the EU Biodiversity Strategy for 2030 and Target 18 from COP-15, which calls for reforming subsidies harmful to biodiversity (Kunming-Montreal Global Biodiversity Framework 2022).

A major issue for rewilding is that existing subsidy schemes are often target-based (Table 2); "pillar one" of the CAP relies on farmers meeting measurable ecological targets over time (Leventon et al. 2017). This is easier achieved through active ecosystem management. For existing subsidy programs to be diversified toward rewilding, payments cannot be made based on such measurable goals. Instead, they must be tuned to the nontarget-based nature of rewilding, reflecting the way in which the land is being managed, e.g., through metrics of reduced human interference over time. There is potential to test this model within the UK's proposed Environmental Land Management Scheme—a rethinking of the subsidy agenda in response to leaving the EU. While it may seem counterintuitive to make payments based on no management of the land, this would facilitate rewilding, and the return of key ecosystem processes.

Payment for Ecosystem Service (PES) schemes for rewilding would likely operate similarly to subsidies (Table 1). In theory a market-based mechanism, most PES schemes exist under governmental controls (Vatn 2014). Rewilding provides important ecosystem services (Cerqueira et al. 2015). However, it would be challenging to provide a reliable supply over time, as the ecosystem state is dynamic. By contrast, in active restoration, interventions can be targeted toward consistent service provision. A novel PES scheme for rewilding could target the existence values people hold for a given project, monetizing positive externalities that may emerge far from the restored site.

Market-Based Mechanisms

Impact Investment. Rewilding projects can be of unique interest to impact investors, aiming to address social and environmental challenges alongside achieving financial returns

Table 1. Summary of funding mechanisms applied to conservation and their supply and demand-side actors. Nonmarket mechanisms are highlighted in red and market instruments in blue.

Funding mechanism	*Description*	*Supply*	*Demand*
Domestic budget allocation and donations	Governmental budget allocation, philanthropy and donations from conservation NGOs are all mechanisms falling under the umbrella of "grants and domestic budget allocation". These mechanisms involve a single "donation" of capital, or repeated donations of capital over time, toward conservation, where no return payment or service from the supplier is expected.	NGO government	Philanthropy government
Subsidies	Governments can target environmental outcomes through subsidies. Agri-environment subsidies are of major relevance to biodiversity.	Land owner	Government
Biodiversity offsets	Biodiversity offsets seek to compensate for negative biodiversity impacts, involving a transaction between polluters (the buyers) and the providers of offsets, who act as sellers (Gonçalves et al. 2015). The reference to net outcomes within offsetting, whether that be no net loss, or net gain, of biodiversity, implies natural resources will continue to be lost in some locations, provided there are sufficient gains in biodiversity elsewhere through prevention of anticipated biodiversity loss or active restoration (Maron et al. 2018).	Business land owner	Business government
Payments for ecosystem services	In theory, PES programs function by the beneficiary of a specific, well-defined, ecosystem service paying the "producer" for a service (Wunder et al. 2008)	Land owner	General public ("market" application)/ government (function similar to subsidies)
Certification	In certification markets, producers can target ethical consumers by charging a price premium on goods and services with positive environmental externalities (Pirard 2012).	Business—producer of certified product	General public
Direct biodiversity fees	Direct markets for conservation exist in cases where a consumer pays for direct access to biodiversity, such as in ecotourism.	Government land owner	General public

(Rode et al. 2019). A key barrier to the growth of impact investment into rewilding is the lack of investable-ready products. While asset managers are increasingly interested in investing sustainably (Pinchot et al. 2019) there is often misalignment in what is investment ready. To attract investment, projects must show a clear return on investment profile (Löfqvist & Garrett 2022). Since many rewilding business models are untested, risk remains high, with potential returns often small. Rewilding Europe Capital was formed in 2013 to help rewilding-businesses that often struggle to secure investment due to their high-risk profile. Using public funding, they are able to offer loans with low interest rates, helping de-risk novel rewilding-based business models.

Direct Biodiversity Fees. Direct biodiversity fees are a widely-used mechanism for rewilding funding (Table 1). Since funding is purely dependent on a consumer being willing to pay for access to biodiversity, e.g., through ecotourism, specific ecological targets do not need to be met. At the Faia Brava Star Camp, in Western Iberia, visitors contribute to local rewilding through a "rewilding levy" (Rewilding Europe 2020).

The potential for a rewilding site to generate income from ecotourism depends on the rewilding strategy employed (Table 2). At the beginning of a passive rewilding project on degraded land, the income from tourism is likely minimal, as the ecosystem is perceived as being in an unfavorable state and will take time to restore. In a trophic rewilding project, where apex species have been reintroduced from the outset, the returns from tourism are likely faster, since visitors are preferentially attracted to megafauna (Berti et al. 2020); this is an attraction for consumers not generally present within restoration strategies employed in Europe.

Table 2. Opportunities and challenges for operationalizing funding mechanisms for rewilding in Europe.

Funding mechanism	*Pros*	*Cons*	*Scalability*
Domestic budget allocation and donations	Large amount of capital to tap into As rewilding increases in popularity, so will funding from this stream	Governmental funding is dependent on the political landscape Finance is often not guaranteed over time	Public and private funding for rewilding has potential to be upscaled
Subsidies	Existing payment infrastructure in place that supports sustainable land use Can target abandoned agricultural land	Existing subsidy schemes are target-based and would need to be modified for rewilding	There exists significant potential to reimagine existing subsidies, such as the CAP, to support rewilding
Offsets	Self-sustaining ecosystems created by rewilding more likely to provide ecological gains over time	Current standards are difficult to apply to rewilding, particularly carbon offsets Concept of additionality harder to demonstrate with rewilding than active, managed, restoration	Would require modification of current offsetting standards to allow for the uncertainty of rewilding
Direct biodiversity fees	Rewilding can be a significant draw for ecotourism Costs over time are likely to be less for rewilding areas	Human pressures can negatively impact rewilding projects	Already existing markets for ecotourism associated with rewilding areas. Potential to develop rewilding ecotourism further as new rewilding sites are established, and current rewilding tourism businesses grow
Certification	Supplementary income on rewilded land Development of a certification scheme for rewilding would allow consumers to preferentially select rewilding-based products	Production on rewilded areas likely to be lower than for traditional schemes under certification Production on rewilded land needs to be balanced against food production needs	There exists some potential to increase rewilding funding through creation of a novel certification standard, alongside projects tapping into existing standards where appropriate
Payments for ecosystem services	Rewilding can have a number of ecosystem service benefits	Nontarget based and unpredictable nature of rewilding means reliable delivery of certain ecosystem services is difficult For isolated rewilding projects it would be difficult to identify beneficiaries of the ecosystem services	Potential to develop novel schemes focusing on cultural service provision, however overall upscaling likely limited

Certification. Creation of a certification standard for rewilding-associated products would allow consumers to preferentially select products from rewilding areas (Table 1). While certification from established bodies such as the Rainforest Alliance involve hitting specific ecological criteria, such as tree species richness and percentage canopy cover (Takahashi & Todo 2014), certification standards for rewilding need to be flexible, reflecting the ecosystem trajectory toward self-sustainability (Table 2). Indicators proposed by Torres et al. (2018) and Segar et al. (2022), offer a pathway to creating a certification scheme for rewilding.

At Knepp Estate, a rewilding estate in West Sussex, wild-range meat products are sold at a premium price, with the nature of production adding an additional profit of 1,500 GBP per animal over the wholesale price (Rewilding Britain 2021). Knepp further supplements this income through ecotourism and agri-environmental subsidies (Dempsey 2021). Rewilding has potential to be upscaled in Europe, with nascent nature-based-businesses such as Nattergal looking to tap into emerging natural capital markers to finance rewilding projects (Nattergal 2022). Still, there are limits to upscaling. Projects must be considered against the wider need for food production;

the "Knepp model" is promising on land where conventional production is no longer profitable.

Offsets. Biodiversity offsets operate in the context of "no net loss", yet their success, even under active restoration programs, is often questionable (Zu Ermgassen et al. 2019) and makes conceptualizing offsetting schemes for rewilding difficult. A further barrier is the concept of additionality—whether the biodiversity gain would've occurred had the intervention not taken place (Gonçalves et al. 2015). The most common method to ensure additionality is through active ecosystem restoration (Maron et al. 2012). The unpredictability within rewilding means additionality can be difficult to prove. However, the emphasis on self-sustaining ecosystems suggests biodiversity benefits could be more long term than with conventional offsetting projects, which can often lead to functionally impoverished ecosystems (Maron et al. 2012). The novel CreditNATURE project (UK Research and Innovation 2020) is developing a service where landowners map biodiversity and carbon on their land in order to generate rewilding credits, offering potential to better link rewilding and offset markets.

Conclusion

The unique characteristics of rewilding mean that certain funding mechanisms are currently ill-suited to cater for its special needs. Mechanisms that rely on reaching a specific ecosystem state need to be adapted to include flexible standards that allow for the unpredictably within the rewilding approach. However, rewilding also offers funding advantages when compared with alternative restoration approaches. First, rewilding focuses on long-term ecosystem self-sustainability, thus management costs over time may be minimal (Schou et al. 2021). Second, the emotional appeal of rewilding means consumers may be more likely to support rewilding ventures. Finally, rewilding is currently a minor land use in Europe; as governments attempt to hit environmental targets there exists potential for upscaling.

While the ways in which rewilding has been funded are narrow, we highlight the potential for upscaling and diversifying rewilding funding. Specifically, we advocate developing existing mechanisms to incorporate metrics that are better suited to the nontarget-based nature of rewilding, such as reduced human intervention. Impact investment is a promising avenue to increase rewilding funding in Europe, as investors look toward sustainable investments. Although there still remains a long way to go in order to "de-risk" rewilding-based projects, innovative new nature-based business models can help bridge the gap between investors and rewilders. Furthermore, blended finance models, that combine public and private funding, can help de-risk investments (Löfqvist & Garrett 2022). We call on practitioners to consider a wider range of potential mechanisms to fund rewilding, and encourage investors to support novel business models.

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LITERATURE CITED

Barbier EB, Burgess JC, Dean TJ (2018) How to pay for saving biodiversity. Science 360:486–488. https://doi.org/10.1126/science.aar3454

Berti E, Monsarrat S, Munk M, Jarvie S, Svenning JC (2020) Body size is a good proxy for vertebrate charisma. Biological Conservation 251:108790. https://doi.org/10.1016/j.biocon.2020.108790

Carrell S (2019) Danish billionaires plan to rewild large swath of Scottish highlands. *The Guardian*

Carver S (2019) Rewilding through land abandonment. In: Pettorelli N, Durant SD, du Toit JT (eds) Rewilding. Cambridge University Press, Cambridge. https://doi.org/10.1017/9781108560962.006

Carver S, Convery I, Hawkins S, Beyers R, Eagle A, Kun Z, et al. (2021) Guiding principles for rewilding. Conservation Biology 35:1882–1893. https://doi.org/10.1111/cobi.13730

Cerqueira Y, Navarro LM, Maes J, Marta-Pedroso C, Honrado JP, Pereira HM (2015) Ecosystem services: the opportunities of rewilding in Europe. Pages 47–64. In: Pereira HM, Navarro LM (eds) Rewilding European landscapes. Springer, Cham. https://doi.org/10.1007/978-3-319-12039-3_3

Corlett RT (2016) Restoration, reintroduction, and rewilding in a changing world. Trends in Ecology and Evolution 31:453–462. https://doi.org/10.1016/j.tree.2016.02.017

Dempsey B (2021) Everything under control? Comparing Knepp estate rewilding project with 'traditional' nature conservation. PLoS One 16:e0241160. https://doi.org/10.1371/journal.pone.0241160

Dempsey J, Suarez DC (2016) Arrested development? The promises and paradoxes of "selling nature to save it". Annals of the American Association of Geographers 106:653–671. https://doi.org/10.1080/24694452.2016.1140018

Deutz A, Heal G., Niu R, Swanson E, Townshend T, Zhu L, Delmar A, Meghji A, Sethi S., Tobin-de la Puenta J (2020) Financing Nature: closing the global biodiversity financing gap

Gammon AR (2018) The many meanings of rewilding: an introduction and the case for a broad conceptualisation. Environmental Values 27:331–350. https://doi.org/10.3197/096327118X15251686827705

Gonçalves B, Marques A, Soares AMVDM, Pereira HM (2015) Biodiversity offsets: from current challenges to harmonized metrics. Current Opinion in Environmental Sustainability 14:61–67. https://doi.org/10.1016/j.cosust.2015.03.008

Kunming-Montreal Global Biodiversity Framework (2022) Non-paper on item 9A

Leventon J, Schaal T, Velten S, Dänhardt J, Fischer J, Abson DJ, Newig J (2017) Collaboration or fragmentation? Biodiversity management through the

Common Agricultural Policy. Land Use Policy 64:1–12. https://doi.org/10.1016/j.landusepol.2017.02.009

Löfqvist S, Garrett R (2022) Unlocking the potential of private finance for forest and landscape restoration. Research Square. https://doi.org/10.21203/rs.3.rs-1851634/v1

Loth A, Newton A (2018) Rewilding as a restoration strategy for lowland agricultural landscapes: stakeholder-assisted multi-criteria analysis in Dorset, UK. Journal for Nature Conservation 46:110–120. https://doi.org/10.1016/j.jnc.2018.10.003

Maron M, Brownlie S, Bull JW, Evans MC, Von Hase A, Quétier F, Watson JEM, Gordon A (2018) The many meanings of no net loss in environmental policy. Nature Sustainability 1:19–27. https://doi.org/10.1038/s41893-017-0007-7

Maron M, Hobbs RJ, Moilanen A, Matthews JW, Christie K, Gardner TA, Keith DA, Lindenmayer DB, McAlpine CA (2012) Faustian bargains? Restoration realities in the context of biodiversity offset policies. Biological Conservation 155:141–148. https://doi.org/10.1016/j.biocon.2012.06.003

Merckx T, Pereira HM (2015) Reshaping agri-environmental subsidies: from marginal farming to large-scale rewilding. Basic and Applied Ecology 16:95–103. https://doi.org/10.1016/j.baae.2014.12.003

Nattergal (2022) Nattergal

Pe'er G, Zinngrebe Y, Moreira F, Sirami C, Schindler S, Müller R, et al. (2019) A greener path for the EU Common Agricultural Policy. Science 365:449–451. https://doi.org/10.1126/science.aax3146

Pereira HM, Navarro LM (eds) (2015) Rewilding European landscapes. Springer, Cham. https://doi.org/10.1007/978-3-319-12039-3

Perino A, Pereira HM, Navarro LM, Fernández N, Bullock JM, Ceauşu S, et al. (2019) Rewilding complex ecosystems. Science 364:aav5570. https://doi.org/10.1126/science.aav5570

Pinchot A, Sato I, Christianson G, Zhou L (2019) Unpacking green targets: a framework for interpreting private-scetor bank's sustainable finance commitments

Pirard R (2012) Market-based instruments for biodiversity and ecosystem services: a lexicon. Environmental Science and Policy 19-20:59–68. https://doi.org/10.1016/j.envsci.2012.02.001

Rewilding Britain (2021) Case study: Knepp Estate

Rewilding Europe (2020) Nature-based economies

Rode J, Pinzon A, Stabile MCC, Pirker J, Bauch S, Iribarrem A, et al. (2019) Why 'blended finance' could help transitions to sustainable landscapes: lessons from the unlocking Forest finance project. Ecosystem Services 37:100917. https://doi.org/10.1016/j.ecoser.2019.100917

Schou JS, Bladt J, Ejrnæs R, Thomsen MN, Vedel SE, Fløjgaard C (2021) Economic assessment of rewilding versus Agri-environmental nature management. Ambio 50:1047–1057. https://doi.org/10.1007/s13280-020-01423-8

Segar J, Pereira HM, Filgueiras R, Karamanlidis AA, Saavedra D, Fernández N (2022) Expert-based assessment of rewilding indicates progress at site-level, yet challenges for upscaling. Ecography 2022(4):1–10. https://doi.org/10.1111/ecog.05836

Svenning JC (2020) Rewilding should be central to global restoration efforts. One Earth 3:657–660. https://doi.org/10.1016/j.oneear.2020.11.014

Svenning J-C, Pedersen PBM, Donlan CJ, Ejrnæs R, Faurby S, Galetti M, et al. (2016) Science for a wilder Anthropocene: synthesis and future directions for trophic rewilding research. Proceedings of the National Academy of Sciences of the United States of America 113:898–906. https://doi.org/10.1073/pnas.1502556112

Takahashi R, Todo Y (2014) The impact of a shade coffee certification program on forest conservation using remote sensing and household data. Environmental Impact Assessment Review 44:76–81. https://doi.org/10.1016/j.eiar.2013.10.002

Torres A, Fernández N, Ermgassen SZ, Helmer W, Revilla E, Saavedra D, et al. (2018) Measuring rewilding progress. Philosophical Transactions of the Royal Society B: Biological Sciences 373:20170433. https://doi.org/10.1098/rstb.2017.0433

UK Research and Innovation (2020) CreditNATURE - An innovative platform to enable landowners to model and apply for carbon and biodiversity credits

Van der Zanden E, Verburg P, Schulp CJ, Verkerk PJ (2017) Trade-offs of European agricultural abandonment. Land Use Policy 62:290–301. https://doi.org/10.1016/j.landusepol.2017.01.003

Vatn A (2014) Markets in environmental governance - from theory to practice. Ecological Economics 105:97–105. https://doi.org/10.1016/j.ecolecon.2014.05.005

Wunder S, Engel S, Pagiola S (2008) Taking stock: a comparative analysis of payments for environmental services programs in developed and developing countries. Ecological Economics 65:834–852. https://doi.org/10.1016/j.ecolecon.2008.03.010

Zu Ermgassen SOSE, Baker J, Griffiths RA, Strange N, Struebig MJ, Bull JW (2019) The ecological outcomes of biodiversity offsets under "no net loss" policies: a global review. Conservation Letters 12:e12664. https://doi.org/10.1111/conl.12664

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