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Using Strategy Games to Support Ecosystem Restoration Planning

Aim: Raise awareness about the role and contribution of strategy games to restoration of landscapes or seascapes that require collaboration and negotiation among diverse stakeholders, including protected area managers, private landowners, local authorities, civil society groups, among others.

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Board used in a participatory strategy game exploring native woodland restoration pathways in Scotland. Players negotiate land-use decisions and trade-offs among restoration, livelihoods, and ecosystem services. © Ivan P. Novotny

Stakeholders participating in a strategy game session, illustrating the social learning and negotiation processes central to collaborative restoration planning. © Ivan P. Novotny

Purpose of this document

This technical note aims to provide guidance on the use of participatory strategy games to support ecosystem restoration planning. It introduces the rationale behind using serious games as tools for stakeholder engagement, knowledge co-production, and decision-making in complex social-ecological contexts. Drawing on literature and case studies, this note outlines the design principles, implementation strategies, benefits, limitations, and ethical considerations associated with applying these methods in restoration projects.

Audience: Restoration and protected area practitioners working within larger landscapes or seascapes with diverse stakeholders. This note will help them understand how strategy games can help them bring diverse stakeholders together to discuss issues around the landscape/seascape that needs to be restored.

What Are Strategy Games?

Strategy games create a rule-based playing space in which participants can assume roles and engage with complex situations in a simplified and relatable way. They take many forms, ranging from board games and role-playing games to theater and video games, and these formats can be combined. What makes them "strategic" is that players, carrying their own values and understanding of the world, must pursue self-imposing goals in a rule-based system characterized by limited resources, complex social-ecological interaction, and delayed consequences. Strategies emerge as players analyze the system and anticipate outcomes, but crucially, as they negotiate with others which trade-offs are acceptable. Through this process, players iteratively adjust their decisions in response to both system feedback and social interaction.

Unlike recreational games, strategy games are designed for serious purposes such as stakeholder engagement and dialogue in diverse or even conflictual settings, knowledge co-production, systems thinking, and policy experimentation (e.g., Speelman et al., 2014). They function as tools that bridge science, policy, and practice across disciplines and sectors (Meadows, 2009).

Historically, strategy games have been closely associated with military contexts, where stakes are high and outcomes uncertain. More recently, they have gained widespread use in addressing environmental and ecosystem management challenges (Garcia et al., 2022). They have been broadly used for forest governance (Purnomo et al., 2018), water management (Arnal et al., 2016), and education and training (Etienne et al., 2011). They support deliberation over difficult trade-offs between food production, carbon sequestration, conservation, restoration, and more, and can be designed and played with the very stakeholders who face these choices in real life.

Why Restoration Needs Innovative Approaches

Ecosystem degradation remains a critical global challenge, contributing to biodiversity loss, reduced ecosystem services, and increased vulnerability to climate change (Díaz et al., 2019; IPBES, 2019). In response, ecosystem restoration has gained global momentum, exemplified by the UN Decade on Ecosystem Restoration 2021–2030 (UNEP & FAO, 2023), which aims to prevent, halt, and reverse the degradation of ecosystems worldwide. Restoration is essential not only for biodiversity conservation but also for enhancing carbon sequestration, water regulation, soil health, and community livelihoods (Aronson et al., 2006; Chazdon et al., 2017).

Despite widespread recognition of ecological and societal importance of ecosystem restoration, planning and implementation remain highly complex. Restoration projects often operate under uncertain ecological outcomes, competing land uses, diverse stakeholder values, priorities, limited resources, and governance fragmentation (Menz et al., 2013; Suding et al., 2015). These interacting uncertainties and institutional frictions often result in uncertain capital return, weak coordination, misaligned incentives, and limited community engagement, constraining the implementation, effectiveness, and durability of restoration projects.

Addressing these challenges requires tools that can make complexity tangible, surface divergent values, and support collective learning and coordination among stakeholders. Strategy games are a valuable tool in

collaborative problem-solving precisely because they can represent complex systems while allowing participants to experience the consequences of their decisions in interaction with others.

Through this shared, experiential process, participants can develop a better understanding of system dynamics, interdependencies, and trade-offs inherent in ecosystem restoration. By engaging multiple stakeholders in restoration projects (e.g., investors, farmers, communities, NGOs, local authorities), strategy games create a structured space for interaction, perspective-taking, and negotiation. In doing so, they support stakeholder engagement, integration of diverse knowledge systems, and exploration of trade-offs under realistic constraints. Rather than prescribing solutions, participatory games help stakeholders jointly explore pathways toward shared objectives, thereby strengthening coordination, mutual understanding, and commitment. The following sections examine the specific contributions of participatory gaming to restoration projects.

When to Use Strategy Games (and When Not To)

Strategy games are not universally applicable. Their value depends on the nature of the restoration challenge, the stakeholder landscape, and the resources available. The following criteria can help practitioners assess whether a strategy game approach is appropriate for their context.

Consider using a strategy game when:

- Multiple stakeholders hold competing interests over the same landscape or seascape. Games are most powerful when no single actor controls outcomes, when farmers, landowners, conservation bodies, local authorities, and communities all have a stake and must negotiate. If your restoration project sits within this kind of contested space, a game can surface those tensions productively and in a lower-stakes setting than a formal meeting.
- Stakeholders lack a shared understanding of the system. If actors understand their own piece of the puzzle but not how their decisions affect others, a game can build that systemic view quickly. This is especially useful early in a planning process, before positions harden.
- Trust is low but direct confrontation is counterproductive. Games provide an "alibi" for difficult conversations, players can explore conflict through the roles and rules of the game rather than as themselves. This can unlock dialogue that formal workshops would not.
- You are in an early or exploratory planning phase. Games are best at opening up options and surfacing values, not at finalizing decisions. If restoration objectives and interventions are still being scoped, a game can inform that process meaningfully.
- You have time for design, facilitation, and follow-up. A well-run session requires investment before and after gameplay. Budget at minimum several weeks for design and testing, half a day to a full day for the session itself, and a structured plan for how insights will feed into subsequent steps.

Be cautious, or consider alternative approaches, when:

- Decisions are already made. If restoration plans are effectively finalized and stakeholder engagement is primarily about communication or compliance, a strategy game may raise expectations of influence that cannot be met, and damage trust as a result. More transparent information-sharing formats are likely more appropriate.
- The primary knowledge gap is technical, not social. If the main uncertainty is ecological (e.g., which species to plant, what hydrological intervention to use) rather than about stakeholder priorities and trade-offs, technical expert consultation or modelling will serve you better than a game.
- Stakeholder conflict is at a level where shared participation is not yet feasible. Games require participants to be in the same room and engage in good faith. In contexts of acute conflict or deep mistrust, preparatory trust-building work may need to come first.
- Resources for facilitation and follow-up are not available. A poorly facilitated game, or one with no follow-up, can do more harm than good, reinforcing existing power dynamics, raising false expectations, or simply being perceived as a waste of time. If you cannot resource it properly, it is better to wait.

- **Your stakeholder group is very small and relationships are already well-established.** If only two or three actors are involved and they already communicate effectively, the overhead of game design may not be justified. Simpler dialogue formats will likely suffice.

Designing and Deploying Strategy Games: Step-by-Step

When used in participatory modelling projects, strategy games are often co-designed with multiple stakeholders to improve realism and foster transparency and inclusivity, to integrate local knowledge, to build trust and learning and to support collective decision-making. Their development follows an iterative process, characterized by ongoing interaction with stakeholders to progressively refine the scope, rules, and mechanics. Despite this non-linear trajectory, the overall workflow can be summarized in three main steps (Figure 1):

1. Context analysis
    - *Problem Framing and Scoping* – Define the goals of the game and the social-ecological system of interest, in collaboration with relevant stakeholders. For example, a game might focus on balancing biodiversity protection with agricultural expansion in a watershed.
    - *Stakeholder Identification and Role Definition* – Determine who will participate and what roles they will play (e.g., protected area managers, Indigenous Peoples, landowners, government, NGOs, rural communities).
    - *Indicator Selection and System Simplification* – Identify key indicators (e.g., the population of an endangered species, water quality, food production) and simplify real-world dynamics to a playable, relatable model.

Figure 1 Three-phase iterative framework for serious game design: context setting, game development, and facilitated game sessions.

2. Game development
    - *Rule and Mechanic Development* – Translate the simplified model into rules, decision options, incentives, and consequences.
    - *Prototyping and Testing* – Conduct playtests with target users and refine the design based on feedback.
3. Game session
    - *Game Facilitation and Session Planning* – Prepare facilitators to run the game, ensure logistical setup, and clarify the agenda, which includes time for reflection.
    - *Debriefing and Reflection* – Conduct a structured debriefing immediately after gameplay to analyze experiences, extract insights, and relate them to real-world contexts.
    - *Documentation and Follow*-Up – Share outcomes with stakeholders and, when possible, integrate game insights into ongoing processes.

Strengths and Limitations of Strategy Games

Strengths

- Shared understanding – Bring together stakeholders from diverse backgrounds to exchange perspectives and develop a common language around complex issues.
- Safe experimentation – Enable exploration of trade-offs, system dynamics, and policy levers without real-world risk.
- Revealing system dynamics – Surface interdependencies, feedback loops, power imbalances, conflicting incentives, and opportunities for cooperation that may remain hidden in conventional discussions.
- Negotiating trade-offs and compromise – Provide a structured space for jointly framing problems, negotiating priorities, making concessions, and exploring pathways toward shared goals under constrained conditions.
- Engagement and ownership – Increase motivation and commitment by actively involving participants in shaping scenarios, decisions, and outcomes.

Limitations on Direct Real-World Impact

Despite these strengths, translating game insights into concrete action remains challenging:

- Lack of institutional pathways – few workshops establish commitments or identify champions to follow up.
- Structural barriers – bureaucratic boundaries, funding gaps, and political reluctance can block outcomes.
- Temporal discontinuity – one-off exercises rarely build the sustained trust and iteration needed for long-term change.
- Weak integration – results are often disconnected from existing planning or regulatory frameworks.

Strategy games are simplified simulations of reality rather than real-world decision-making environments, and they should not be interpreted as predictive tools. Instead, they provide a virtual space in which actors can explore possible futures, anticipate trade-offs, and negotiate responses under controlled conditions. As such, they help participants reflect on potential pitfalls and plan ahead, while remaining distinct from actual policy implementation. Consequently, many games remain in the realm of education, research, or dialogue rather than directly shaping policy or restoration practice. However, this does not preclude their relevance for policymaking: by supporting deliberation and decision-making under uncertainty, strategy games can inform more robust and context-sensitive policy design.

How Impact Can Be Enhanced

- Embed games within longer participatory processes or policy windows.
- Plan follow-up steps: documentation, action plans, and assignment of responsibility.
- Involve local champions or institutions with implementation capacity.
- Use iterative sessions to strengthen trust and build ownership.

Case Study Examples from Different Regions

Although there is limited precedent for strategy games specifically addressing the intersection of protected areas and ecosystem restoration, the following case studies draw on related initiatives in land management and conservation. The scarcity of documented applications in restoration likely reflects structural factors rather than a lack of relevance: projects are often driven top-down by governments or private investors, with local authorities primarily acting as intermediaries between implementing agencies and communities (Ding et al., 2023).

Yet restoration projects involve multiple stakeholders, competing objectives, uncertainty, and delayed feedback,

making them particularly well suited to strategy games. By providing a safe environment to explore trade-offs, reveal system dynamics, and negotiate priorities, games can complement expert-driven planning with stakeholder learning and ownership. Adapting approaches proven in land management to restoration contexts therefore represents an opportunity to strengthen inclusive decision-making and build a practice-based evidence base for participatory restoration.

Below we describe a few case studies to illustrate how strategy games can be deployed under different social-ecological contexts:

Tropical Forests – Indonesia

In Indonesia, strategy games such as the Landscape Game are grounded in real-world dynamics of palm oil expansion, where economic incentives, governance gaps, and power asymmetries shape land-use decisions. Empirical studies show that land clearing through fire remains attractive due to its low cost (approximately USD 15 per hectare) compared to alternative methods, despite being illegal. At the same time, significant increases in land value following plantation establishment create strong incentives for rapid expansion. Within this system, actors operate under unequal power relations, with processors and large-scale actors exerting greater influence over value chains than smallholders. These dynamics illustrate how trade-offs between short-term economic gains and environmental outcomes are not only technical but also shaped by governance structures and actor interactions. Strategy games built on these principles allow participants to explore how such incentives and asymmetries influence decision-making, and to test how alternative policy measures or coordination mechanisms might alter outcomes (Purnomo et al., 2018). Facilitators should also bear in mind that these stakeholder groups are rarely homogeneous: environmental values can vary considerably from one island or ethnic group to another, and continued in-migration means that many villages now bring together residents with divergent social, cultural, and economic priorities, a heterogeneity that game design and role definition should deliberately account for.

Temperate Europe – Scotland

ScotScape is a board game developed by researchers at ETH Zurich that includes restoration options together with farming and forestry activities to simulate land-use trade-offs in rural Scotland. It involves roles such as estate owners, smallholder farmers, and policymakers. In a typical session, estate owners prioritized forestry expansion to maximize revenues, while smallholder farmers could not afford afforestation due to high costs and competing land use. Policymakers introduced subsidies to incentivize mixed land use, but these were often captured by larger landowners. As rounds progressed, players began forming informal coalitions to coordinate land-use decisions and influence policy design. This revealed how communication patterns and power asymmetries can shape both equity outcomes and the effectiveness of policy instruments. (Rödlach et al., 2026). Facilitators should likewise account for heterogeneity within these roles: priorities and values around restoration can differ markedly between rural and urban populations and across generations, so that older and younger participants, for example, may hold quite different views of what restoration should achieve, differences worth building into player profiles and scenario design.

Coastal and Marine Ecosystems – Philippines and Indo-Pacific

Coastal and marine seascapes present some of the most complex multi-stakeholder management challenges: fishers, tourism operators, conservation agencies, local government units, and aquaculture interests often compete for the same coastal strip under conditions of rapid ecological degradation and high livelihood dependency. ReefGame, a board and computer model tool developed through the Coral Reef Targeted Research Program, was used in participatory workshops in the Philippines bringing together local fishers, local government officers, provincial environmental officers, coast guards, tourism and aquaculture representatives, and NGO workers (Cleland et al., 2010). During play, participants encountered the core tension of the system directly: short-term fishing pressure generated immediate income but degraded the reef habitat on which future catches

depended. Analysis of these workshops found that participants used narrative, humour, and informal communication to signal resistance and build alliances, revealing that game sessions can function as rehearsal spaces for more inclusive deliberation, particularly when facilitators allow improvisation rather than rigid adherence to a fixed script. A complementary tool, the Mangal Play, developed at Université Libre de Bruxelles for mangrove social-ecological systems across the Indo-Pacific and East Africa, showed that prompting participants to distinguish bottom-line positions from negotiable ones helped surface where compromise was genuinely possible , a distinction rarely made explicit in conventional stakeholder meetings (Dahdouh-Guebas et al., 2022).

Implications for practice

Participatory strategy games are most effective when used as early-stage engagement tools within restoration planning processes. Introducing games before objectives and interventions are fully defined can help stakeholders surface divergent values, clarify trade-offs, and develop a shared understanding of system dynamics, thereby informing more socially grounded and realistic restoration pathways.

Their impact is strongest when games are embedded within broader participatory processes, rather than treated as standalone workshops. Practitioners should plan how insights from gameplay will feed into ongoing planning, decision-making, or policy discussions, including documenting outcomes and identifying follow-up steps or institutional anchors. Without such integration, games risk remaining isolated learning experiences.

Finally, strategy games should be seen as a complement to technical expertise, not a replacement. While they can support collective sense-making, scenario exploration, and dialogue across stakeholder groups, they do not generate solutions on their own. Their primary value lies in strengthening coordination, mutual understanding, and ownership, creating conditions under which ecological knowledge and formal planning tools can be applied more effectively.

Conclusions

Strategy games provide a flexible, engaging, and participatory means of navigating the complexities of ecosystem restoration. By enabling stakeholders to simulate and reflect on land-use dynamics, they can improve mutual understanding, test policy options, and identify shared pathways forward. Their use should be intentional, well-designed, and linked to ongoing processes to maximize impact. As restoration efforts expand globally, participatory strategy games offer an innovative complement to traditional planning approaches, building both insight and momentum for change.

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