

Towards Increased Community-Engaged Ecological Restoration: A Review of Current Practice and Future Directions

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ABSTRACT

In recent years there has been a growing critique of the dominance of technical approaches to ecological restoration, and a recognition of the importance of the social considerations required for restoration to be successful in the long term. In light of this, our paper offers a review of community engagement in the ecological restoration literature. We identify factors, that if ignored, run the risk of undermining the long-term sustainability of restoration projects. We then identify social strategies for dealing with these factors. Undermining factors have been summarized into three key ones: power dynamics, ignoring and/or generating negative livelihood impacts associated with restoration activities, and untested assumptions about local communities. Seven core strategies were identified to deal with these issues. Two of these examples include engaging in active community participation, and supporting landscape dependent livelihoods. These seven strategies tend to recognize, work with and support locally evolving social-ecological systems. Our findings suggest that restoration practitioners need to be intentionally aware of and challenge the pervasive ideology of social-ecological dualism that dominates modern thinking and western scientific approaches and undermines the long-term sustainability of many ecological restoration projects.

Keywords: community engagement, dualism, participation, people-centered, social-ecological

Restoration Recap

- This paper provides a review of community engagement in the ecological restoration literature specifically to identify factors that run the risk of undermining the long-term sustainability of restoration projects, and social strategies for dealing with these factors.
- Restoration practitioners need to be intentionally aware of and challenge the pervasive ideology of social-ecological dualism that dominates modern thinking and western scientific approaches and undermines the sustainability of many ecological restoration projects.
- Social strategies should be adopted that support locally evolving social-ecological systems. These include engaging

in active community participation (Weng 2015), working with local knowledge and institutions (Singh et al. 2011), supporting landscape dependent livelihoods (Balana et al. 2010), accommodating local values and needs (Schaich 2009), fostering social-ecological learning (Kiker et al. 2001), providing educational programs that deepen local ecological understanding and value (Schaich 2009) and applying systematic approaches that facilitate an understanding of local social-ecological systems (Rehr et al. 2014).

Ecological restoration is an evolving practice that has changed considerably over the past two decades. There

has been a shift away from a static view of ecosystems that can be returned to some ideal condition, towards more process-oriented approaches that regard ecosystems as changing, and that highlight the need for attention to be paid to the processes through which restoration is implemented. Underpinning this latter shift has been an emerging critique of approaches that ignore the social aspects of restoration. This critique has opened up a space for more people-centered perspectives on restoration processes,

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including those highlighting the need to understand the biodiversity-generating aspects of cultures and local people's practices. In light of this, we provide reflections on the shift to more socially focused approaches that have occurred in ecological restoration. We also explore restoration approaches that either facilitate or undermine successful restoration efforts.

In the early 1990s ecological restoration was defined by the Society for Ecological Restoration (SER) as "the intentional alteration of a site to establish a defined indigenous, historic ecosystem. The goal of this process is to emulate the structure, function, diversity, and dynamics of the specified ecosystem" (Aronson et al. 1993, SER Primer 2002). Some of the controversy around this early definition revolved around the difficulty of defining a historical condition (Higgs 1997, Allison 2004), clarifying what is meant by health, integrity, and sustainability (Allison 2004), the impracticality of simply reconstituting isolated and fragmented vegetation patches (Choi et al. 2008), the evolving nature of ecosystems as they respond to a changing context, and the fact that restoring a historical condition is not necessarily going to produce an ecosystem able to adapt to a rapidly changing climate (Choi et al. 2008).

These kind of critiques led the SER to devise the new definition of ecological restoration in the early 2000s. Here, ecological restoration was defined as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER 2004, McDonald et al. 2016). The emphasis had shifted from a goal to a process orientation (Clewell and Aronson 2013), and now focused on recovering a historic trajectory that included particular ecosystem functions and processes (Winterhalder et al. 2004, Choi et al. 2008). The aim is to restore ecological "integrity, wholeness and health" including "suitable composition, structure and abiotic support, normal levels of ecological function, capacity for self-organization and resilience, and sustainability to the same degree as that shown by reference ecosystems" (Clewell and Aronson 2013, p 182). This revised SER definition of ecological restoration supports the community focus of this paper.

Commentators have noted that the early emphasis on restoring a fixed ecosystem community supported the dominance of scientific and technical aspects of ecological restoration projects to the neglect of attending to the complementary social dimensions (Higgs 1997, Van Diggelen et al. 2001, Davis and Slobodkin 2004, Higgs 2005). This has been the case despite the recognition within ecological restoration literature that local people are integral to ecosystems (Aronson et al. 2006, Burke and Mitchell 2007, Egan et al. 2011, Shackelford et al. 2013) and that participatory processes that include local voices, morals and values and thus garner local support is essential for long-term success of restoration projects (Light and Higgs 1996, Higgs 1997, Van Diggelen et al. 2001, Higgs 2005, Choi et al. 2008, Shackelford et al. 2013).

Despite critiques against overly technical restoration projects that ignore the social component, there is a continuing emphasis on increasingly efficient, technical, large-scale ecological restoration projects, for such varied reasons as the global carbon market and its synergies with biodiversity conservation (e.g., Pierce et al. 2009), or the amelioration of the impacts of large dams (M. Powel, Rhodes University, pers. comm.). This has allowed for the technical approaches to continue to dominate the ecological restoration arena (Light and Higgs 1996, Higgs 1997, Higgs 2005, Higgs 2017). The danger is the production of "austere," "fragile," and commodified restoration projects that elevate effectiveness and efficiency over participatory processes that might guarantee the long-term sustainability of restoration initiatives (Higgs 1997, Higgs 2005). In addition, restoration agendas may be taking place regardless of local community needs, while in contradiction, community buy-in is essential for the project's sustainability. For example, the recently proposed Ntabalenga Dam in the Tsitsa catchment, South Africa, has resulted in an ambitious restoration project to address the potential siltation levels in the future reservoir (K. Rowntree, Rhodes University, pers. comm.). This restoration project is driven by a national agenda rather than local needs, but requires buy in from the local population if it is to be sustainable.

The contexts of many ecological restoration projects, as described above, support a systematic integration of current knowledge about the challenges and opportunities of community-engaged ecological restoration on a global stage. In light of this, our paper offers a review of community engagement in the ecological restoration literature specifically to identify factors that run the risk of undermining the long-term sustainability of such initiatives, and social strategies (to be used by restoration practitioners and policy makers) for dealing with these factors. We integrate the results of this research with insights from other fields, where experiences with participatory approaches have matured over decades. The purpose of the paper is to provide researchers and practitioners engaged in ecological restoration efforts with a useful reference point for common pitfalls in practice, and to offer recommendations for improved social engagement processes in the context of ecological restoration efforts.

Methods

This review involved two phases in order to identify relevant literature. First, an exploratory phase involved initial wide-ranging literature searches using Science Direct and Google Scholar (which came up with 1000s of potential papers). The purpose of this exploratory phase was to identify search terms that would return articles dealing specifically with the community engagement aspects of ecological restoration. Refined search terms were needed as using the search term restoration had 3,510,000 results in

Google Scholar and 144,472 results for Science Direct, the majority of which were not relevant to the topic. Refined search terms were therefore needed. Once effective search terms were identified, the second phase of the review was initiated. Science Direct was used, with a publication date limited to 2000–2015, and the following key words were applied: “Ecological restoration” AND “Local people”; “Restoration” AND “People”; “Restoration” AND “Institutions”; “Restoration” AND “Participation”. Of the 117 papers returned in the searches, 85 papers were included and 32 were excluded. Papers were excluded that did not relate to the social dimensions of ecological restoration. The [supplementary materials](#) provide a full list of papers used for the analysis.

Content analysis, referring to the systematic and objective selection and analysis of content themes was used to initially examine the data (Nachmias and Nachmias 1990). The two content themes selected were: 1) the factors that undermine the long-term sustainability of ecological restoration efforts; and 2) the social strategies that have been used to deal with these factors.

Relevant data relating to each theme was copied into a document. Thirty-six of the 85 papers contained data related to undermining factors and 68 papers contained data related to strategies. Data under each theme was then read and an initial inductive analytical process was followed to code for emergent factors under each theme. In this process, every line of data was coded according to common properties emerging in the data. These codes were then grouped into similar concepts to make the data more workable. As the coding process continued throughout the data, the developing concepts were compared with each other, modified and sharpened. From these concepts, three undermining factors and seven strategies were identified and these are discussed in the following section.

Results and Discussion

Factors with the Potential to Undermine Long-term Sustainability of Restoration Efforts

Three factors with potentially negative effects on the sustainability of ecological restoration efforts feature repeatedly in the literature, namely power dynamics, ignoring and/or generating negative livelihood impacts, and untested assumptions about local communities and ecological systems. Each of these factors are discussed in turn. A summary of these factors, including the percentage of papers, examples and further reading is provided in Table 1.

Power Dynamics

Sixty-four percent of papers indicated that power dynamics are a key factor that can undermine the long-term outcomes of community engaged restoration efforts (Table 1). Such power dynamics relate to both the ways in which

restoration teams interact with communities and how communities are internally organized. What nature to restore is often contested and complicated by the reality that different stakeholders (from land managers, local communities, conservation groups, volunteers and government) have diverse interpretations of a valued landscape (Weng 2015). Power is thus frequently expressed in every day decisions regarding what is restored, where, and how.

In spite of collaborative approaches being promoted restoration processes continue to be organized around scientific knowledge and top down, “expert” driven processes (Fleeger and Becker 2008). Western knowledge systems therefore remain hegemonic. The consequence is that locally accountable and representative leadership is sidelined (Ribot 2002), and local people’s voices remain limited in critical decisions (Kaplan and Kaplan 2009, Couix and Turpin 2015, Weng 2015).

River rehabilitation in Europe, for example, has been largely carried out as an engineering and natural science exercise with little attention paid to social needs (Åberg and Tapsell 2013). Sandlos and Keeling (2016), basing their work on a case study of a restoration project in Australia, describe how traditional knowledge and values were sidelined in an environmental remediation process that framed the issues as technical and scientific. They refer to epistemic injustices “where marginalized social groups cannot render intelligible their respective experience and perspectives on terms acceptable to the dominant culture” (Sandlos and Keeling 2016, 8). This results in increased mistrust and alienation amongst Aboriginal people. Such poor relationships between local people and restoration experts is a common problem (Stenseke 2009, Ramirez-Andreotta et al. 2014). This technical and scientific focus runs the risk of sidelining the required social process by offering limited opportunities for effective participation of local resource users (Leino and Peltomaa 2012, Benages-Albert et al. 2015, Weng 2015).

The above representation of authors’ voices indicates the inequality that characterizes restoration processes. Local people, including indigenous peoples and others particularly vulnerable in the modern, globalized world, can suffer under ecological restoration projects (Åberg and Tapsell 2013, Sandlos and Keeling 2016). For ecological restoration to have beneficial social-ecological outcomes, this inequality needs to be addressed.

Power dynamics are also integral to communities themselves (Stone et al. 2008, Datta et al. 2012, Weng 2015). Decades of experience in community-based natural resource management highlights the structural and institutional inequalities that characterize communities (Bradshaw 2003, Kumar 2005, Datta et al. 2012). This is often expressed in monopolized leadership structures in which, for example, the chief has all the decision-making power (Ribot 2002, Datta et al. 2012). There is, consequently, the danger of biased or corrupted leadership and

Table 1. A summary of factors that hold the potential to undermine long-term sustainability of restoration efforts. (These categories are not mutually exclusive, where the same paper may have contained data relevant to several of the undermining factors). See [Supplementary Table S1](#) for further readings.

Undermining factors	% of papers (n = 36)	Examples	Further readings
Power dynamics	64%	Science regarded as the only valid source of knowledge; local values delegitimized; technical and scientific focus presents limited opportunities for effective participation; power dynamics integral to local community dynamics.	e.g., Fleeger and Becker 2008, Weng 2015, Sandlos and Keeling 2016.
Ignoring and/or generating negative livelihood impacts	44%	Restrictions on local people's use of resources; emphasis on ecological goals to the detriment of livelihood goals.	e.g., Nagothu 2001, Balana et al. 2010, Cao et al. 2010.
Untested assumptions about local communities and ecological systems	36%	Local communities regarded as the key degrading force; local communities idealized and social dynamics simplified.	e.g., Leino and Peltomaa 2012, Åberg and Tapsell 2013, Zhong et al. 2013.

elite capture (Ribot 2002, Shackleton et al. 2002, Stenseke 2009, Saito-Jensen et al. 2010), in which those in power hold the potential to derive most of the benefits from a particular restoration process (Datta et al. 2012). Gender is important in this context, with men often benefitting disproportionately (Shackleton et al. 2002, Badola et al. 2012). Navigating internal power dynamics is therefore essential in community engaged restoration efforts.

Ignoring and/or Generating Negative Livelihood Impacts

Forty-four percent of papers point to the fact that ecological restoration projects can negatively impact local livelihoods, with negative knock-on effects on the sustainability of the restoration efforts (Table 1). In China, Ethiopia, and Rajasthan (India) for example, it has been reported that for restoration purposes, communities are excluded from areas and natural resources critical to rural livelihoods (Nagothu 2001, Balana et al. 2010, Cao et al. 2010). In China, the lack of compensation for the losses to livelihoods in this case has resulted in increasing poverty for many, and, when questioned, almost a third of residents (about 125 million rural people) indicated that due to the negative impacts they have felt they will return to their previous unsustainable practices when the programs end (Cao et al. 2010). In Ethiopia, exclusion was met with active resistance (Balana et al. 2010), while in Rajasthan exclusion led to growing conflicts and disrupted forest management efforts (Nagothu 2001). Negatively impacting livelihoods can, therefore, negatively impact restoration outcomes. Ignoring and/or generating negative local livelihood impacts also perpetuates inequalities in restoration projects and reinforces the dangerous idea that people are separate from ecosystems. On the other hand, productive landscapes that support local livelihoods, increase people's cultural attachment to the land and their willingness to protect the land (Weiss 2004, Buijs 2009, Åberg and Tapsell 2013).

Untested Assumptions about Local Communities and Ecological Systems

Thirty-three percent of papers highlighted that untested assumptions underpinning the ecological restoration process can threaten successful outcomes for both ecosystems and communities (Table 1). Untested assumptions regarding ecological functioning that are simplistic, mechanistic and limit possibilities are a concern (Leino and Peltomaa 2012, Dang et al. 2013, Fan et al. 2015). Numerous assumptions are also made regarding the social dimension of restoration efforts. One such assumption is that local communities are the “key force degrading natural resources” (Nagothu 2001, p 320). This view informs misguided restoration interventions that exclude local people from management of their resources and entrenches the negative impact on local people's livelihoods, as described in the previous section.

An apparently obvious answer to this has been a push for more community-inclusive approaches to restoration processes (e.g., Valladares-Padua et al. 2002, Stenseke 2009, Åberg and Tapsell 2013). However, many highlighted the danger of adopting naive, idealistic, and simplistic views of local communities. We know from other literature concerning participatory and community-based natural resource management that an often-made naïve assumption is that communities are homogenous. Numerous authors (Kellert et al. 2000, Bradshaw 2003, Kumar 2005, Lu et al. 2005, Saito-Jensen et al. 2010, Schafer and Bell 2010, Sakurai et al. 2015) highlight the heterogeneity, diversity of interests and values, hierarchical nature, and elusiveness to a clear definition that rather characterizes “communities,” and the consequent difficulty of identifying community boundaries.

Community conflict is a key factor in community-engaged restoration efforts due to such heterogeneity (Kellert et al. 2000, Castro and Nielsen 2001, Datta et al. 2012), which is compounded by introduced change and unfulfilled

Table 2. A summary of social strategies to support effective community engaged ecological restoration projects. (These categories are not mutually exclusive, where the same paper may have contained data relevant to several of the strategies). See Supplementary Table S2 for further readings.

Social strategies	% of papers (n = 68)	Rationale	Further reading
Active community participation	59%	Fosters greater buy-in & facilitates a just process that supports local people's needs.	Thorton et al. 2007, Luyet et al. 2012, Åberg and Tapsell 2013.
Supporting local livelihoods	29%	Ensures a more equitable process where local people's well-being is not undermined.	Balana et al. 2010, Badola et al. 2012, Zhong et al. 2013.
Respecting people's values and perspectives	27%	Promotes feelings of emotional connection & increased cultural value with the local landscape.	Schaich 2009, Couix and Turpin 2015, Sakurai et al. 2015.
Fostering learning	19%	Deepening knowledge of social-ecological systems supports greater adaptation of human systems with the ecological world.	Kiker et al. 2001, Stenseke 2009, Giebels et al. 2015.
Providing environmental education	15%	Promotes healthier social-ecological system interaction by strengthening human knowledge of, connection with & positive action in the ecological world.	Valladares-Padua et al. 2002, Goltenboth and Hutter 2004, Schaich 2009.
Supporting local institutions	13%	Institutions provide the link between human & ecological systems.	Lu et al. 2005, Singh et al. 2011, Wilson et al. 2013.
Apply a systematic approach	13%	Provides a systematic approach that facilitates understanding local social-ecological systems	Balana et al. 2010, Ritzema et al. 2010, Rehr et al. 2014.

expectations (Musumali et al. 2007). As described earlier, power dynamics, including inequality and monopolized leadership structures, also characterize communities, thus limiting the united response and equitable approaches that is often naïvely assumed to characterize collaboration (Stone et al. 2008, Datta et al. 2012, Weng 2015). In addition, community disempowerment and lack of capacity can limit effective community involvement (Fleeger and Becker 2008). Idealized notions of communities living in harmony with nature are equally dangerous, as they can ignore the fact that many traditional social-ecological practices have been eroded through globalizing forces, such as industrialization, consumerism and urbanization (Kellert et al. 2000).

Summary

All of these dynamics, taken together, highlight the level of complexity, difficulty, and time-consuming process that must, of necessity, characterize meaningful participation in community-engaged restoration efforts. The challenges posed by ecological restoration projects outlined in this section hold the potential to fundamentally undermine their “restorative” agendas. They point to a neglect by restoration practitioners to truly engage with the human dimension and thereby reinforce the inequalities experienced by vulnerable people dependent on local ecosystems for their survival. The undermining factors also provide no recognition that local people have co-evolved with local ecosystems, and thus perpetuate the idea that humans are separate from ecosystems. In the section that follows we identify a number of social strategies and future

directions that might assist restoration teams to navigate these complex social-ecological realities on the ground.

Future Directions and Social Strategies for Overcoming Factors that Undermine the Long-term Sustainability of Restoration Efforts

A variety of social strategies have been identified in the literature as important for confronting the issues presented in the previous section. These include: fostering active community participation, supporting local livelihoods, respecting people's values and perspectives, fostering learning among all participants (including scientists), providing environmental education, supporting local institutions and applying a systematic approach that facilitates understanding local social-ecological systems (Table 2).

Active Community Participation & Building Relationships

The importance of active community participation in ecological restoration projects is widely recognized, with 59% of papers calling for this. Active participation offers local people a meaningful role to play in initiatives that aim to improve their lives. This is through genuine involvement in defining project objectives, making decisions, implementation and monitoring outcomes (Lu et al. 2005). Active participation of this kind can foster greater buy-in and offers the possibility of a just process that might support local people's needs. This compares to minimal type participatory approaches where little opportunity exists for meaningful local participation (Stenseke 2009). Authors indicate the importance of active participation in ensuring

the success of restoration projects (Weiss 2004, Thornton et al. 2007, Luyet et al. 2012, Åberg and Tapsell 2013, Couix and Turpin 2015, Weng 2015) as it supports cultural sustainability (Schaich 2009), social acceptance (Luyet et al. 2012, Binder et al. 2015), increased trust (Luyet et al. 2012), direct and indirect benefits to local communities (Yeemin et al. 2006), and long-term economic and environmental success (Lu et al. 2005). Including local or traditional knowledge and values in decision making within a project is a particularly important aspect of participation, highlighted in 7% of the papers (e.g., Weng 2015). Building relationships is also an important element of successful participatory processes (Hodge and McNally 2000, Valladares-Padua et al. 2002, Stenseke 2009, Åberg and Tapsell 2013, Weng 2015). Developing trust, expressing respect, and clear communication are key ingredients, while face to face contact enables this (Singh et al. 2011). Fostering active participatory processes, therefore, holds the potential to mitigate the key undermining factors highlighted in the previous section. These processes confront power dynamics head-on, avoid the neglect of local livelihoods, and actively test assumptions regarding communities and their relationships with ecosystems.

There are many examples of participatory processes having positive social-ecological outcomes. For example, a participatory process, within and surrounding the Morro do Diabo State Park, in Brazil, was fundamental to the cooperation that developed between local people and conservationists (Valladares-Padua et al. 2002). The goal was to involve local people in the sustainable management and restoration of local forests. Scientific knowledge of the region's ecology and its value was shared with local stakeholders. Extensive time was also spent listening to local people to ensure their opinions were respected and cultural values taken into account. Local people were then involved in the decision-making process to ensure the inclusion of both social and environmental interests. The process facilitated transparency, respectful sharing of scientific knowledge, and discussions of means to improve local people's quality of life (Valladares-Padua et al. 2002). In another example, the Chinese government's Sloping Land Conversion Program, the world's largest reforestation program, has recently experienced an important policy shift, in which local autonomy and participation are being promoted (He 2014). However, He (2014) highlights the importance of a participatory approach being more than mandatory policy and political slogans; such an approach requires an extensive understanding of the local context, legitimization of local institutions, while also ensuring local capacity for institutional development.

Supporting Local Livelihoods

Twenty-nine percent of papers highlighted the importance of restoration projects actively supporting locally valued livelihoods. This is no easy task, as livelihoods may be

at the expense of ecological health due, for example, to local people being caught in a poverty trap or living in agriculturally marginal areas (Orsi et al. 2011). Despite this challenge, Orsi et al. (2011) are clear that restoration projects are likely to only be sustainable when they have ensured local people can continue receiving the ecosystem benefits they have come to rely upon. This also enables a more equitable process in which local people's wellbeing is not undermined and thus addresses the inequity discussed under power dynamics. Balana et al. (2010) emphasize the importance of harmonizing local economic needs and environmental sustainability, while Badola et al. (2012) state that ecosystem benefits are likely to accrue when those who gain from such ecosystems are involved in their management.

From China to Brazil to India, case studies show both the social and ecological benefits of combining restoration efforts with positive livelihood outcomes. In a marginal and poverty stricken part of China, the strategy was to combine a viable ecological restoration approach with a sustainable socio-economic focus. The historical Chinese use of terrace engineering was reinvigorated as a means to retain water, prevent soil erosion, improve soil conditions and thereby increase the productivity and livelihood potential of the area (Zhong et al. 2013). This example shows the value of paying attention to local knowledge and building on local expertise as the basis for restoration interventions. In Morro do Diabo, in the state of Paulo, Brazil, environmentalists and locals began to co-operate in a dynamic where their objectives were historically opposed (Valladares-Padua et al. 2002). Through an agro-ecology approach, both agricultural and ecological outcomes have been achieved, thus improving quality of life for local people and the guaranteed protection of wildlife and the region's forests. In the degraded catchment of the Attapady Hills, in Kerala, South India, the physical improvement of the watershed, combined with socio-economic activities and local people's participation led to the willing adoption of soil and water conservation interventions, spring rejuvenation and improvement to local livelihoods (Vishnudas et al. 2012).

Respecting People's Values & Perspectives

In line with the above, 27% of papers highlight the value of restoration efforts being informed by local people's perspectives as a way to ensure successful landscape restoration efforts. Restoration projects that ignore social values can lead to "long lasting public discontent" and conflict between restoration practitioners and local people (Åberg and Tapsell 2013, p 95). In contrast, if social values are promoted and restoration projects are designed to enhance aesthetic, recreational, emotional and productive benefits, feelings of emotional connection and increased cultural value can develop with the landscape being restored (Schaich 2009, Åberg and Tapsell 2013). Local cultural

systems have co-evolved with the local ecological systems (Schaich 2009) and consequently people feel a deeper sense of connection with nature when there are cultural elements to identify with (Åberg and Tapsell 2013). If there is an erosion of cultural elements in the landscape, the local ecological connection is therefore likely to be diminished. Supporting a local connection with the landscape means that the necessary long-term public support of ecological restoration projects is more likely (Sakurai et al. 2015).

Fostering Learning

Learning is identified as an ingredient of successful restoration projects identified in 19% of the papers. Such learning explores ecological and social complexity (Giebels et al. 2015), links knowledge to action in adaptive ways (Kiker et al. 2001, Singh et al. 2011, Giebels et al. 2015), includes participatory and long-term monitoring of the restored site (Singh et al. 2011, Zhong et al. 2013), is collaborative and co-produced (Stenseke 2009, Singh et al. 2011), holistic (Kiker et al. 2001), and encourages and integrates different forms of knowledge, including local, traditional and scientific (Stenseke 2009, Singh et al. 2011). Deepening knowledge of social-ecological systems supports understanding of specific systems and contexts, and can inform improved adaptation to ecological change.

Providing Environmental Education

Some authors (15%) argue that environmental educational processes should support restoration initiatives (e.g., Goldenboth and Hutter 2004, Schaich 2009, Le Lay et al. 2013). Such initiatives promote healthier social-ecological system interaction by strengthening human knowledge of, connection with and positive action in the ecological world. Case studies indicate that local people's value for the natural world increases substantially through environmental education programs. Valladares-Padua et al. (2002) describes the positive consequence of environmental education programs on one of the world's most threatened ecosystems, namely the Brazilian Atlantic Forest. Local people living close to forest patches give them little value. However, evidence shows that when conservation activities were accompanied by environmental education initiatives these people become "supporters of and active participants in, forest conservation" (Valladares-Padua et al. 2002, p. 73). In the northern province of Tigray, Ethiopia, there is rapidly diminishing forest cover due to unsustainable resource use and poor management (Balana et al. 2010). Environmental education on sustainable forest management proved to be the most important factor supporting sustainable community forestry (Balana et al. 2010).

Supporting Local Institutions

Restoration initiatives that involve local institutions in environmental management may have better chances of success, as emphasised in 13% of the papers. This supports

Ostrom's (1990) initial theory of the importance of institutions in effective ecological management. One of the primary reasons for this is because institutions are the link between human and ecological systems (Lu et al. 2005), mediating people's access to and use of natural resources. By supporting local institutions, restoration practitioners recognize the co-evolution of local social-ecological systems. Research indicates that the two key institutional ingredients for effective environmental management are locally made and enforced rules and community monitoring (Singh et al. 2011). Important additional factors include effective local leadership, community organization, social learning, and the presence of multi-scale institutions that manage resources at applicable scales (Singh et al. 2011, Wilson et al. 2013).

Apply a Systematic Approach to Facilitate Understanding of Local Social-ecological Systems

A variety of models, tools and approaches have been identified (13% of papers) as important for adopting a more systematic means to meet community orientated ecological restoration objectives by understanding local social-ecological systems. These include multi-criteria decision analysis, systematic scenario analysis and Participatory Learning and Action. Multi-criteria decision analysis provides an analytical framework that considers a variety of factors when making a decision. This can include a diversity of stakeholder's views and values, thus supporting understanding and communication among a variety of stakeholders involved in a participatory process (Balana et al. 2010). Such a framework can also provide insight into the tradeoffs of different ecosystem-based management decisions (Linkov et al. 2006). Systematic scenario analysis is a computer-based tool, also used to evaluate ecosystem related management options (Rehr et al. 2014). Participatory Learning and Action is an approach that can be adopted when the aim is collaborative learning and planning with communities (Ritzema et al. 2010). The approach encourages active engagement of local people in prioritizing the issues that concern them and provides the means to design and reshape landscape properties that meet both ecological and livelihood objectives, thus proving highly valuable in the restoration context.

Summary

The social strategies outlined above provide a variety of means through which restoration practitioners and researchers can recognize and support the social dimension of restoration processes to enhance their long-term sustainability. There appears to be convergence on the need to recognize and strengthen the link between social and ecological systems.

Different strategies are useful for addressing each of the three undermining factors. Table 3 provides a matrix that links the undermining factors to different strategies. Active

Table 3. A matrix of the three undermining factors and strategies to address these, as identified in the literature.

	Power dynamics	Ignoring and/or generating negative livelihood impacts	Untested assumptions about local communities and ecological systems
Active community participation	•	•	•
Supporting local livelihoods	•	•	
Respecting local people's values and perspectives		•	•
Fostering learning	•		
Providing environmental education	•		
Supporting local institutions	•	•	•
Apply a systematic approach	•	•	•

community participation, supporting local institutions and applying a systematic approach challenges each of the three undermining factors. Supporting local livelihoods tackle power dynamics and negative livelihood impacts, while respecting local people's values and perspectives addresses power dynamics and untested assumptions. Fostering learning and providing environmental education limit power dynamics between local people and restoration practitioners.

Conclusion

There is a growing recognition that human and ecological systems are connected and evolving, as expressed in the study of social-ecological systems (Folke and Gunderson 2012). Through an extensive reading and analysis of the literature on the social dimensions of ecological restoration literature, factors that undermine restoration success were identified as well as social strategies for mitigating these. Factors that undermine the long-term sustainability of ecological restoration can be grouped under three main themes: power dynamics, ignoring and/or generating negative livelihood impacts, and untested assumptions about local communities and ecosystems. Related issues include the fact that science is too often regarded as the only valid source of knowledge in restoration efforts, which further delegitimizes local knowledge and values in decision making processes. Social-ecological dualism, an ideology that positions people and nature as separate and unrelated entities, which has dominated not only modern society but also western science, is one explanation at the root of these prevalent issues in ecological restoration projects (Fox 2014).

Strategies for dealing with the undermining factors outlined in this paper tend to confront this pervasive ideology by recognizing, working with, and supporting locally evolving social-ecological systems. Strategies include: engaging in active community participation; recognizing, validating and working with local knowledge and institutions; supporting landscape dependent livelihoods; understanding and designing programs that accommodate local values and needs; fostering social-ecological learning among all participants; providing educational programs that deepen

local ecological understanding and value; and applying systematic approaches that facilitate understanding of and practices in local social-ecological systems.

The restoration literature reviewed here indicates that an exclusive ecological focus in restoration efforts diminishes chances of success. However, we are not advocating a naïve approach to social systems: a key question must be how potentially destructive human systems can be accommodated in ecological restoration projects? This is a particularly important question in a globalized, modern context where many cultural practices, institutions and values, seemingly adapted to local ecosystems, have been eroded (Garibaldi and Turner 2004, Higgs 2005). This raises the possibility of focusing attention on the human aspects of social-ecological systems that might also need to be "restored". Higgs (2003) for example, coined the concept "ecocultural restoration" to emphasize both the ecological and cultural dimensions required for successful restoration projects. Garibaldi and Turner (2004, p. 13) state that "We need to restore not only landscapes but also the diversity-enhancing capabilities of the human communities inhabiting those landscapes." Casagrande and Vasquez (2009) explore the concept of restoring for cultural-ecological sustainability and argue that both cultural and ecological processes be included in restoration to enhance co-evolution of people and nature. There are, of course, several ethical challenges related to such thinking in the context of practical restoration projects: who determines what needs to be restored, for whom, and at what cost? In the absence of dealing with the very real power inequalities currently experienced in ecological restoration projects in terms of knowledge and the primacy of western science and technology, as laid out in this paper, such an approach holds more danger than promise.

This paper provides ecological restoration practitioners with a reflective moment to consider the importance of including the social element in restoration projects. There are however, two primary limitations to this study. The first is that the papers identified and analyzed came from only one search engine, namely Science Direct. The second limitation is that only one coder was used for the analysis. This points to the small scope of this study. The findings from this literature review will be strengthened by a more

extensive review that ensures broader inclusion of relevant papers and triangulation of findings. Including additional search engines and data coders will help achieve this. The value of a comprehensive study such as this will be the increased weight of its findings, focusing on a socially oriented approach to ecological restoration.

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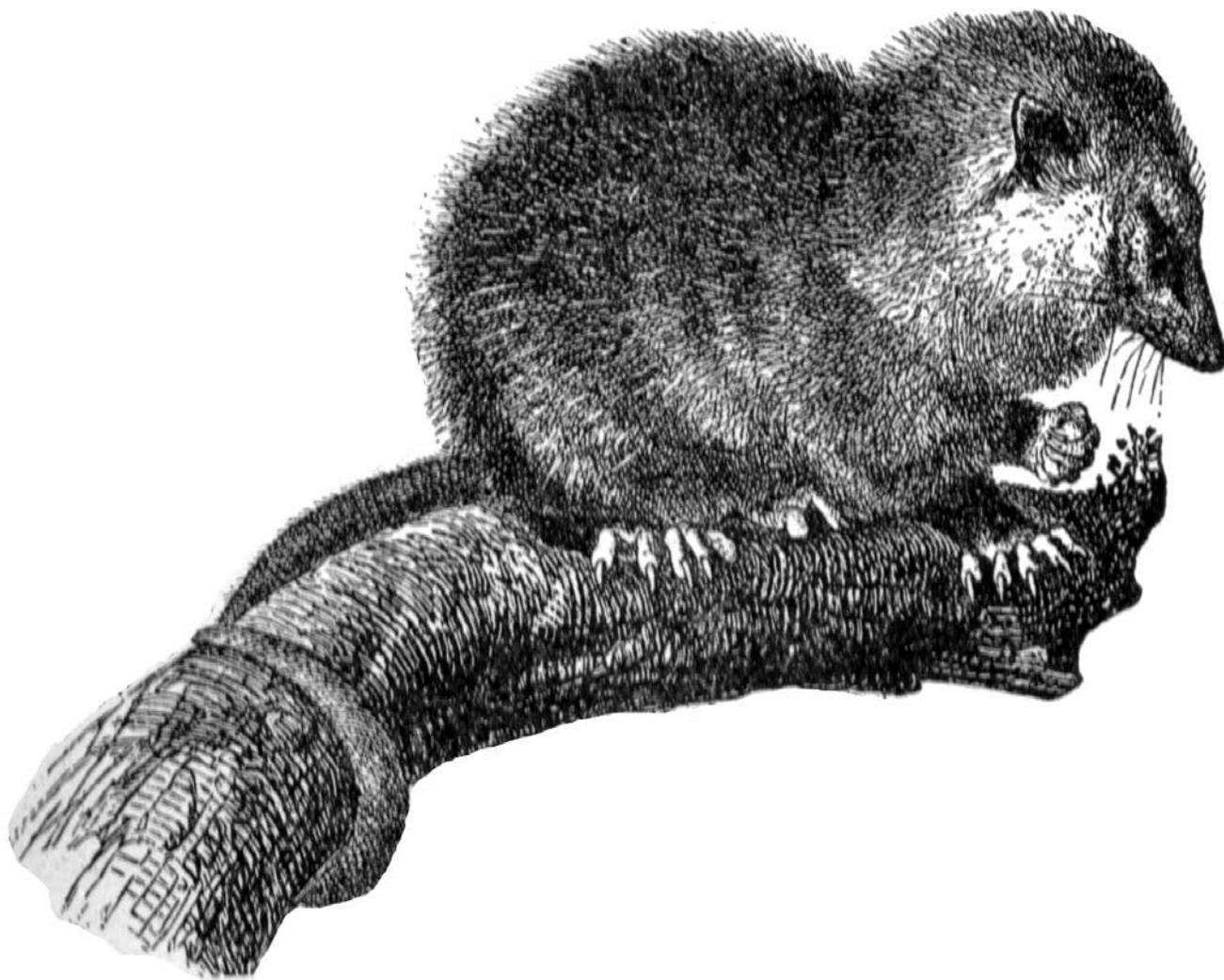
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