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## Continuity and change in forest restoration. A comparison of US ecology and forestry in the 1940s and 1990s

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### ABSTRACT

Previous research has paid little attention to the multiple meanings of the concept of forest restoration. To gain a more comprehensive view of forest restoration, this paper compares the US forest restoration debate of the 1940s and 1990s, in the disciplines of ecology and forestry. The paper focuses on historical approaches to pasts and futures, and on “sociotechnical imaginaries” providing societal legitimacy to restoration ventures. Historical scientific papers constitute the paper’s empirical sources. The analysis shows that, among ecologists and foresters, forest restoration of the 1940s was oriented towards efficiency and challenges such as wood demands during World War II, whereas restoration of the 1990s was oriented towards conservation and environmental challenges. The approaches of the 1940s’ ecologists and foresters seem motivated by a sociotechnical imaginary connecting forest restoration to *societal progress*, whereas the approaches of their 1990s’ counterparts seem motivated by a sociotechnical imaginary connecting forest restoration to the task of *mitigating society’s impacts*. Based on the conclusions, it is argued that future research on forest restoration would benefit from comparing the idealized pasts of both yield- and conservation-oriented conceptions of forest restoration.

### 1. Introduction

The concept of forest restoration refers to the art of reclosing forest canopies or bringing past forests back to life. Although apparently straightforward, forest restoration in practice contains of numerous different enterprises: replanting clear-cuts, replacing old-growth with second growth, reconstructing native forest ecosystem functions, reintroducing extinguished forest species, rewilding managed forest areas, etc. Depending on the historical contexts, forest owner’s aims, engaged scientific expertise, and other social and cultural factors, the concept of forest restoration has appealed to nearly all kinds of stakeholders aiming to improve damaged forestlands (cf. [Stanturf, 2016](#)).

The concept of forest restoration and related ventures has been examined in studies from various disciplines (e.g., [Burton and MacDonald, 2011](#); [Corlett, 2016](#); [de Jong et al., 2021](#); [Higgs et al., 2014](#); [Hirsch and Long, 2020](#); [Hirt, 1994](#); [Jørgensen, 2015, 2019](#); [Keulartz, 2016](#); [Langston, 1995, 2006](#); [Stanturf et al., 2014](#)). Still, little attention has been paid to the range of concepts *between* management and conservation (however, see, e.g., [de Jong et al., 2021](#)). The empirical core of these studies has instead been particular types of forest restoration, such

as rewilding, ecological restoration, or reforestation of timber production areas. While we possess knowledge of multiple types of forest restoration, we lack in-depth understanding of the social and cultural patterns uniting and dividing them.

This study compares different historical periods and scientific disciplines with the aim of gaining a more comprehensive view of forest restoration. We focus on the US debate from the perspectives of two influential disciplines during two formative periods: ecology and forestry in the 1940s and 1990s. The comparison allows us to highlight continuity and change in forest restoration ventures, paving the way for further comparisons in the rich milieu of forest restoration.

The basis of our comparison is an exploration of how ecologists and foresters during the 1940s and 1990s used statements about pasts and futures to legitimate ongoing forest restoration enterprises. In approaching the analysis, we apply the “sociotechnical imaginaries” framework—developed in the field of science and technology studies ([Jasanoff, 2015](#); [Jasanoff and Kim, 2009, 2013](#)). Sociotechnical imaginaries are publically shared and politicized visions of what science and technology *will* cause or achieve rather than what they are doing right now. For instance, comparing nuclear power policies in the USA and

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South Korea, Sheila Jasanoff and Sang-Hyun Kim (2009) found that the USA promoted nuclear power using an imaginary of peace, struggling with associations with the atomic bomb, while South Korea launched it using an imaginary of societal development, counteracting an image of societal stagnation. Given their constitution as visions, rather than descriptions, sociotechnical imaginaries have a performative nature, i.e., they are products of values, articulated to fulfill certain goals, and used as means of power.

The sociotechnical imaginaries framework indeed has a future orientation, but does not rule out dimensions of the past. In fact, analysis of the sociotechnical imaginaries of forest restoration arguably requires a bidirectional focus taking forest restorers' future dreams and fears as well as their framing of the past into account. Forest restoration builds, if nothing else, on the idea of using past states as guidance for the future. When utilizing this framework, we therefore relate ecologists' and foresters' statements about pasts and futures to historical sociotechnical imaginaries providing legitimacy to forest restoration and other science and technology projects.

## 2. Method

This study's empirical material consists of papers in journals that were key forums for US ecology and forestry in the 1940s and 1990s. For the former decade, we selected papers from the journals *Ecology* and *Journal of Forestry*. *Ecology* emerged in 1920 as a successor to the journal *Plant World*. Throughout its history, it has been published by the Ecological Society of America. *Journal of Forestry* dates to 1917 when it succeeded the journal *Forestry Quarterly*. Since then, it has been published by the Society of American Foresters. For the 1990s, we selected papers from *Journal of Forestry* and *Restoration Ecology*. The latter journal, which commenced publication in 1993, is a scientific outlet of the US-based Society for Ecological Restoration. We replaced *Ecology* with *Restoration Ecology* because of the 1990s' specialized scientific media landscape. In other words, we expected to find vital samples of the 1990s' ecological restoration discussions in *Restoration Ecology* rather than *Ecology*.

The papers included in the analysis were found through the site Web of Science. We searched using key terms such as “forest,” “restoration,” “regeneration,” and “reforestation” in various related word forms. We additionally focused on papers dealing with US forests in particular. Eventually, just over 100 papers were selected and read. Divided between the different journals and periods, we read roughly 20 papers from *Ecology* and 40 from *Journal of Forestry* of the 1940s, as well as 30 from *Restoration Ecology* and 20 from *Journal of Forestry* of the 1990s. Some papers found through the Web of Science search did not address forest restoration, but related topics such as prairie restoration. If they were regarded as relevant to forest restoration—for instance, when expressing general thoughts on restoration aims—they were nevertheless included in the analysis.

The selection principles affected our results in certain ways. By concentrating on journals, we captured the stands of institutions, i.e., views advocated or considered appropriate by, for example, scientific editorial boards. This delimitation allowed more generalizable conclusions than if we had concentrated on individual ecologists and foresters. Our focus on institutions also affected how we categorized historical actors. In the “Results” section, we accordingly refer to “foresters” and “ecologists” simply as authors of either *Journal of Forestry* or the two ecological journals, regardless of their other disciplinary affiliations. Also notable is an asymmetry between the 1940s and 1990s. The scientific media landscape in the 1940s was, relative to the 1990s, populated by fewer journals. Taking this into analytical account, we nonetheless wish to stress that quantitative asymmetries are almost unavoidable when making any historical comparison over long time spans.

The analysis comprised five steps. First, we reconstructed the historical contexts of the 1940s and 1990s. Emphasis was placed on

developments in ecology and forestry as disciplines, but also on political priorities relevant to the enterprise of forest restoration. The contexts were constructed from previous research. Second, we located key passages in the selected papers from *Ecology*, *Journal of Forestry*, and *Restoration Ecology*. The authors' statements about pasts and futures were often made while they were framing the study's empirical basis or addressing the study's practical implications. Third, we interpreted the passages in light of their contexts. Fourth, we identified broader historical trends by comparing periods and journals. Fifth, we applied the framework of sociotechnical imaginaries in presenting our results.

## 3. Historical contexts

The discipline of forestry was introduced in the USA at the turn of the 20th century, influenced, among others, by German state forestry (Hays, 1959). German state forestry—at least the version exported to the USA—emphasized order and planning to support the state's economy and was based on techniques such as clear cutting, monocultures, and even-aged stands as well as the goal of sustainable yield (Hölzl, 2010; Lowood, 1990; Warde, 2018). The last required the forester to plan the trees' rotations far into the future to provide the industry with a constant flow of wood. According to historian Samuel P. Hays (1959), in the USA, sustained-yield forestry fused with a progressive “gospel of efficiency.” This ethos or ideology, Hays argues, motivated government authorities such as the US Forest Service, and its iconic first chief, Gifford Pinchot, to fight resource waste and promote efficient land use with mapping, applied science, and large-scale planning (see also, e.g., Demeritt, 2001). As demonstrated by historian Nancy Langston (1995), the US interpretation of sustained-yield forestry spurred early US foresters to transform the forests to save what was perceived as a core resource for future welfare. In their way stood low-yielding, “overaged,” and “decadent” old-growth forests as well as hazards such as fire and overexploitation. While utilizing wood or clearing lands for crops, historical settlers, farmers, and companies had logged the forests heavily—not seldom in a manner unfit with the ideals of sustainability. Fire, however, was a part of the old forest's life cycle and had shaped the forestland for millennia. It was caused by Native American communities as well as by natural occurrences. Moreover, the US interpretation of sustained-yield forestry implied new policies for other, essentially older types of forest use, such as grazing (Langston, 1995). These were not necessarily examples of either waste or overexploitation but rather represented other perspectives on the forestland with potential to conflict with the project of timber production.

During the 1940s, US foresters were preoccupied with various reforestation ventures (Hirt, 1994; Langston, 1995; Robbins, 2004). First, as the object of increased demands during World War II, wood was classified as a “critical war material.” The demands, however, seemed to exceed the supply by far. Second, after the War's end, the USA witnessed an industrial boom based on economic growth and, among other things, increased demands for wood products. Both the war economy and the postwar boom gave, historian Paul W. Hirt (1994) argues, the US Forest Service and other governmental interests reasons to apply significant reforestation programs and expand the implementation of sustained-yield forestry. These also included enterprises not directly linked to profit—but certainly to the gospel of efficiency—, such as the planting of trees to prevent soil erosion (e.g., Dumroese et al., 2005). Important in this story as well were novel technologies such as the chain saw. Still, these actions did not reflect consensus. Hirt also stresses that the 1940s was marked by conflicts between the US Forest Service and the forest industry about regulating private-owned forestland in accordance with sustainable yield principles.

During the early 20th century, the USA had developed into a key nation for the discipline of ecology alongside, for example, Britain and Russia (Ackert, 2013; Anker, 2001; Kingsland, 2015). One important contribution of early US ecology was the approach of “dynamic ecology” (not to be confused with nutrient cycling and other *ecological dynamics*)

(Worster, 1994). Alongside others, plant ecologist Frederic E. Clements had developed the concept of “climax states”—sometimes called “climax formations,” “climax communities,” or “climax associations.” The concept suggested that plant associations as wholes followed evolutionary pathways while adapting to the climate and other environmental factors through plant succession. Eventually, a plant association was expected to reach a state of equilibrium, i.e., a climax, and resist change. Historian Sharon Kingsland (2005) argues that US ecologists developed dynamic ecology while observing roads, cities, farmlands, industries, and other features of the modern human world rapidly alter US landscapes. The approach of dynamic ecology became highly influential in the US during the early 20th century, but was also challenged by, among others, US ecologist Henry Gleason and British ecologist Arthur Tansley.

Early US ecologists sought legitimacy in efficient land management (Kingsland, 2005; Worster, 1994), driven, for example, by the 1930s’ “dust bowl” crisis. Intensive cultivation and reduced precipitation had led to massive dust storms that seriously threatened nature and agriculture in the USA and Canada. The dust bowl crisis became a prime example of the problems of modernizing agriculture, but also, historian Donald Worster (2004) states, of ecology’s practical utility. Exploring the damaged lands from their scientific perspective, ecologists claimed to possess vital explanations to the dust storms’ origins and of how the lands should rightly be managed. Ecologists eventually expanded this professionalization strategy from agriculture into other applied areas, including fishery, forestry, and warfare (Bocking, 1997; Creager, 2013).

Parallel to the expansion of sustained-yield forestry and the development of forestry and ecology as applied sciences, US forests were subject to political efforts to preserve wildlife, wilderness, and the like (Nash, 2014). One example can be found in the New Deal programs alleviating the impacts of the Great Depression in the 1930s. Here, President Franklin D. Roosevelt implemented an iconic “tree army,” a large-scale effort to restore national park areas for recreation purposes and simultaneously create jobs (Alexander, 2018). The preservation of forests for non-production goals became especially important during the postwar period. Besides demands for wood products, the period’s economic growth increased Americans’ interest in hiking, camping, and other outdoor and recreation activities (Hirt, 1994). These different foci would eventually open a gap between management for human aims and preservation relying on exempting wilderness and other nature types from human exploitation.

In the 1990s’ USA, the discipline of ecology was divided into multiple subfields. One such subfield was restoration ecology—including approaches such as rewilding—, focusing on restoring ecosystem functions and the like through species reintroduction, land abandonment, and other means (Jørgensen, 2015; Keulartz, 2016). Most ecological subfields were unified by two methodological advances (Warde et al., 2018; Worster, 1994). First, by focusing on global processes, starting in the 1960s, ecologists developed an interest in computational “big data” systems. Second, they simultaneously turned to the concept of “ecosystem”—developed by, among others, Arthur Tansley, Howard T. Odum, and Eugene P. Odum—and related notions such as “energy,” “nutrient flows,” and “trophic levels.” These developments led US ecologists to consider energy transitions and ecosystem functions, as well as novel sites such as human cities. Still, according to Kingsland (2005), considering objects such as “built environments,” paradoxically, did not lead to the inclusion of humans as social beings in ecological analyses.

Now, ecologists had gained the expert status they had desired half a century earlier. Their specialty was not land management but, as historians Warde et al. (2018) shows, the novel political area of the environment. The 1990s’ environmental discourse particularly drew on the “Earth Summit,” i.e., the 1992 United Nations Conference on Environment and Development in Rio de Janeiro (Radkau, 2014). This discourse incorporated political strivings to globalize the issue of “sustainable development” and to prevent hazards such as desertification and climate change. Also significant for the discourse following the Earth Summit

was the development of “biological diversity” as a guiding policy concept and overarching criterion for evaluating conservation measures (Farnham, 2007; Radkau, 2014).

US forestry of the 1990s was also greatly affected by environmental politics. The divide between management and preservation originating in early 20th century land use politics had developed into a “timber war” (Mårald et al., 2016; Winkel, 2014). Following a “timber era” in the 1980s, when foresters focused on timber production and maximum yield, the 1990s forestry debate was, forest researcher Georg Winkel (2014) demonstrates, marked by polarized conflicts about the conservation of remaining old-growth forests and their inhabiting species. The conflicts initiated a shift in US forestry institutions, with a declining focus on timber production and increasing attention to non-profit goals such as wildlife habitats. The US Forest Service also adopted “ecosystem management” as its guiding principle. To be noted also is that both foresters and ecologists of the 1990s were, compared to those active in the 1940s, working in a different media landscape where mass media technologies portrayed and affected the scientific and political forest agenda.

Besides drawing on them, our comparison casts further light on these contexts. Scholars have demonstrated how the economic politics of the 1940s paved the way for sustained-yield forestry and other land use ventures perceived as efficient, scientific, and planned. Still, unlike the situation with foresters, only minor attention has been paid to the ecologists’ relationship to yield-oriented reforestation programs, though we know that ecologists were oriented towards land management more generally. In parallel, we possess little knowledge of ecological influences on foresters’ understanding of the forests that they intended to restore. Our comparison also deepens our knowledge of how politics advocating for the preservation of wilderness areas, rather than supporting timber production, related to ecology and forestry.

Previous research on the 1990s addressed a set of reversed questions. The decade has been described as witnessing the breakthrough of environmental politics and land management adapted to environmental goals. However, while we know that ecologists, as environmental experts, promoted ventures such as ecological restoration, foresters’ response to such ventures has been less explored. Our comparison additionally casts light on how historical novelties such as ecosystem management and ecological restoration were related to the century-old project of reforestation for yield and welfare.

## 4. Results

### 4.1. Forest restoration in Ecology of the 1940s

Ecologists of the 1940s’ paid attention to the past in several ways. First, corresponding to Clementsian dynamic ecology ideas, several ecologists addressed the “undisturbed” pre-Columbian “climax” landscape altered by European settlers (e.g., Cook and Robeson, 1945; Griggs, 1946; Johnson, 1945). Such an approach to the past was expressed in a paper on the snowshoe rabbit and its choice of food (Cook and Robeson, 1945). The authors treated the rabbit as a survivor from times of “pristine conditions,” i.e., the “original climax forests” existing before “the advent of white men” (Cook and Robeson, 1945, p. 406–407). Pre-Columbian humans, i.e., Native Americans, were methodologically considered agents of change, but dismissed as too few in number to have any substantial effect on the rabbit populations. The rabbit’s diet was highlighted because it included pine and spruce seedlings and therefore caused problems in forest management.

Similar approaches to the past can be found in papers analyzing prairie ecological issues. For example, one ecologist stated, in polemics based on previous research, that short grass plains represented “a true plant climax” and not “a disturbance climax” “brought about by the coming of man and domesticated grazing animals” (Larson, 1940, p. 113). He accordingly set out to prove that wild bison “in pristine numbers” had effects on the plains similar to those of the domesticated

long horned cattle following the arrival “of the white men” (Larson, 1940, p. 114).

Still, ecologists more often looked at recent and less mythologized historical events causing land use problems. Most noteworthy were prairie ecologists’ interpretations of disastrous scenarios in open lands related or similar to the 1930s dust bowl (e.g., Weaver and Darland, 1944; Weaver and Mueller, 1942; Weaver and Zink, 1946). For instance, based on surveys of lands affected by “extreme drought, overstocking, and damage by dust,” Clements’ adept John E. Weaver and his associate Irene M. Mueller (1942, p. 275, 289) stressed the “urgent need for restoration of grass on ranges and abandoned dry land farms.” Weaver also used the concept of “true prairie” in contrast to the contemporary “greatly damaged” prairie (Weaver and Darland, 1944, p. 202). Moreover, several ecologists oriented towards forest restoration highlighted recently failed land management trials (e.g., Johnson, 1945; Stahelin, 1943).

When looking to the future, ecologists were primarily interested in efficient land management and enduring forest cropping systems (e.g., Gemmer et al., 1940; Stahelin, 1943; Wilde, 1940). Past conditions and the plant associations’ ongoing “return” to “climax” states functioned, correspondingly, as methodological reference points for the land’s capacity, and not as ends of conservation. For example, having analyzed the regrowth of coniferous forests after fire, one ecologist argued the following: “knowledge of the natural process involved”—in this case, that the “destruction of the climax association” by fire gave “rise to the establishment of a fire subclimax”—was necessary to find an “efficient solution” to forest restoration issues (Stahelin, 1943, p. 29). The “restoration of the forest by succession [i.e., letting the forest recolonize its former area by itself] is so slow that a serious problem in land management is created,” he furthermore concluded (Stahelin, 1943, p. 19). Similarly, another ecologist classified gley soils as means to “satisfy the needs of silvicultural practice,” including reforestation (Wilde, 1940, p. 34). Yet another explored “reasons for the failure of natural tree regeneration to reclaim” areas of so-called frost pockets (Hough, 1945, p. 235). The frost pockets had created holes in Pennsylvanian forest canopies. The context of the paper was forest management strategies aiming for the “[r]estoration of forest pockets to desirable forest growth,” alternatively to “avoid the creation of additional problem areas of low forest productivity” (Hough, 1945, p. 248–249). The frost pockets were, according to the author, a legacy from the European settlers’ logging “of the original forest” (Hough, 1945, p. 235).

A related view of the future can be found in the prairie ecology papers. Since pristine grasses were believed to keep the soils moist, nutrient rich, and in place, the restoration of original grasslands and true prairies ultimately served economic ends. Weaver and Ellen Zink (1946, p. 115), for example, argued the following: “Man has slowly come to recognize that grass is his most efficient weapon against soil erosion; it is also an excellent preventive of soil depletion.”

Though used in several papers on forests in the 1940s’ *Ecology*, the word “restoration,” along with related words, rarely showed signs of being charged or decisive; rather, the word pointed towards particular scientific orientations or political programs only in exceptional cases. In addition, it seldom indicated the primary purpose of the paper. If associated with particular forest restoration programs, however, restoration referred to reforestation in accordance with sustained-yield forestry. Also to be noted is that the venture of restoration was frequently conceptualized using the terminology of dynamic ecology. The forests or forest features to be brought back were described using words such as “climax” and “disturbance,” a connection that would later be enforced.

#### 4.2. Forest restoration in *Journal of Forestry* of the 1940s

When viewing the past, foresters of the 1940s shared several features with contemporary ecologists. First, the post-Columbian frontier was brought up a number of times, though not as frequently as among the

ecologists. Forester Emanuel Fritz (1943), for example, problematized the early settlers’ forest use in the state of California. Californian forests, Fritz (p. 162) argued, had been highly beneficial “since the white man arrived.” Yet, due to heavy logging and lack of regrowth measures, huge parts of the forest were now cutover lands with low productivity. The post-Columbian frontier also appeared in papers addressing prairie and range management. For instance, one author began a paper on soil and vegetation changes with the following statement: “Before the plow broke the rich virgin sod of the Palouse Prairie, the region furnished one of the finest livestock ranges in America” (Young, 1943, p. 834).

Second, the foresters were looking at other recent historical events causing land use problems. For example, several foresters addressed recent mismanagement resulting in forests not maximizing their economic potential (e.g., Minckler, 1945; Stoekeler and Limstrom, 1942; Wahlenberg, 1949). One forester addressed the “task of reestablishing spruce forests on” “devastated land in the southern Appalachians” (Minckler, 1945, p. 349). Another focused on the restoration of hardwood trees in the Piedmont Uplands where the “hardwoods were destroyed thoroughly” “in the clearing and cultivation of millions of farm lands” (Wahlenberg, 1949, p. 713). In addition, authors also debated the Cooperative Forest Restoration Bill (e.g., Chapman, 1940; Hammar, 1940). The bill suggested that lands degraded by, for instance, heavy logging should be leased from private owners and subjected to government-led economic restoration measures.

Papers were also dedicated to the practical problems of regenerating new generations of trees, including the roles of “natural” and “artificial” regeneration as well as prescribed burning (e.g., Chapman, 1948; Lynch and Schumacher, 1941). Moreover, a number of foresters addressed the stabilization of sand by means of reforestation (e.g., Altpeter, 1941; Lehotsky, 1941).

As expected from their view of the past, foresters looking to the future were primarily concerned with forthcoming harvests in accordance with sustained-yield forestry. This view sometimes took account of social benefits besides wood production. For example, in line with Roosevelt’s tree army, aforementioned forester Emanuel Fritz (1943, p. 166) promoted reforestation to create jobs in the forestry sector—besides ensuring that the next war would not “find us without an abundance of wood.” Several foresters were also rather past oriented in the sense of being guided by, for instance, the land’s vegetation history when articulating future management strategies (e.g., Auten, 1945; Humphrey and Lister, 1941; Young, 1943). For instance, one forester explored sassafras, black locust, pine, and their effects on soil quality as means to “prepare the way for” the “succession of native hardwoods” (Auten, 1945, p. 446). Another addressed ranges that could “be restored to a condition approaching their original productivity” (Young, 1943, p. 838).

Non-timber goals were also discussed. For example, one forester advocated measures to reestablish diminished wildlife (Rutherford, 1941, 1946). Although this proposal was intended to satisfy “millions of nature lovers” enjoying “wildlife in its native habitats,” its chief target was hunters “interested in maintaining a shootable surplus” (Rutherford, 1941, p. 157). These thoughts were expressed in relation to the Pittman Robertson Act of 1937, commonly known as the Wildlife Restoration Act.

A notable part of foresters’ attention was also directed towards future boundaries between the government and the freedom of individual and corporate forest owners. For instance, one forester suggested that the Cooperative Forest Restoration Bill was a “disguised public acquisition of private property” (Chapman, 1940, p., 231, Chapman’s italics).

In the 1940s’ *Journal of Forestry*, the word “restoration” and other “re”-words such as “reforestation” were often central to the authors’ arguments. Here, these words were, unlike in *Ecology*, explicitly associated with scientific orientations and political programs, often those of sustained-yield forestry. Also, in several papers, dynamic ecology words such as “climax” and “disturbance” were, as was the custom in *Ecology*,

used to address past conditions of or processes in the forests. The 1940s' foresters had clearly developed a forest restoration discourse, one that contemporary ecologists lacked.

#### 4.3. . Forest restoration in *Restoration Ecology* of the 1990s

The 1990s' ecologists viewed the past in ways both similar to and different from those of their counterparts in the 1940s. First, several ecologists of the 1990s addressed the post-Columbian frontier (e.g., Fritts et al., 1997; Kaye et al., 1999; Shear et al., 1996; Stone et al., 1999). For instance, one research group addressed ponderosa pine forests as they were before the “Euro-American settlement” (Stone et al., 1999, p. 172). Yet another group directed their attention towards the “reintroduction of wolves” (Fritts et al., 1997, p. 7). A historical background highlighting the settlement and the Europeans' “negative view of the wolf” framed their paper (Fritts et al., 1997, p. 8).

Nevertheless, the past, including events related to settlement, was often addressed when other historical events and processes were being examined. Most noteworthy are various environmental problems defined by institutions such as the Earth Summit. For instance, in a paper on forest restoration near the Mississippi River, the author argued that bottomland hardwood forests had once been “a prominent feature of the southcentral United States landscape at the time of European settlement” (Allen, 1997, p. 125). The *restoration needs*, however, were defined while addressing the “construction of flood control and navigation structures, surface mining, and urban development” during the 20th century (Allen, 1997, p. 125). Similarly, when discussing the restoration of bottomland hardwood forests in Kentucky to pre-Columbian conditions, one research group stressed recent “recognition of the value of wetlands and the concern over their loss” (Shear et al., 1996, p. 111). Yet another group addressed the reforestation of coastal grass plains and highlighted that “the last 200 years [of] human activity” had negatively affected the relationship between trees and grasses, primarily through “agricultural and forestry operations” (Outcalt et al., 1999, p. 262).

When looking to the future, several ecologists advocated rebuilding pre-Columbian or close to pre-Columbian states (e.g., Fritts et al., 1997; Kaye et al., 1999; Shear et al., 1996). However, this call was regularly instrumental, i.e., the “natural” pre-Columbian state provided various environmental services, again in accordance with institutions such as the Earth Summit. For example, one ecologist addressed forest restoration as a means to “establish stands with greater woody species diversity, a more natural appearance, and a more positive environmental impact” (Allen, 1997, p. 125). Similarly, one research group addressed the restoration of pre-Columbian ponderosa pine forests as a way of “improving forest health” (Stone et al., 1999, p. 172). *Restoration Ecology* also featured exceptional authors criticizing the authority of past conditions. For example, in relation to prescribed burning, two ecologists disapproved of “fire management plans [based] on ideas of the historical ‘natural’ occurrence of fire” and argued that the “history of fires in an ecosystem is not necessarily justification for [...] the use of prescribed fire” (Johnson and Miyanishi, 1995, p. 271).

In the 1990s' *Restoration Ecology*, “restoration,” and words such as “rehabilitation” and “reintroduction,” were clearly linked to scientific orientations and political programs of conservation and ecological restoration. Given the journal's scope and title, this was of course to be expected. These “re”-words were additionally associated with an institutionalized scientific terminology with roots in dynamic ecology—characterized by words such as “disturbance” and “pre-” and “post-settlement”—as well as with novel origins—characterized by words like “ecosystem function.”

Also notable is that ecological restoration was perceived as a novel enterprise and not as a continuation of older land use projects. For instance, one ecologist acknowledged the existence of early attempts at the “[r]estoration of the structure and function of forest ecosystems on degraded land” far back in history (Larson, 1996, p. 11). Yet, he argued

that historical forest restorers were occupied with, among other things, restoring “forest cover” or reducing “erosion,” and not with the objective of his generation: “biotic interactions” (Larson, 1996, p. 11).

#### 4.4. . Forest restoration in *Journal of Forestry* of the 1990s

Foresters of the 1990s viewed the past rather differently from their counterparts in the 1940s. First, a number of foresters addressed the post-Columbian frontier, but from a conservation rather than an economic perspective. For instance, one research group wrote papers about ponderosa pine forests and their development from “presettlement” to “postsettlement” phases (Covington and Moore, 1994; Covington et al., 1997). By doing this, the group hoped to identify a “baseline for eventual restoration of more nearly natural patterns and processes” (Covington and Moore, 1994, p. 40).

However, despite papers on presettlement forests and the like, some foresters obviously felt uneasy with words such as “original” and “natural” and put them within quotation marks (e.g., Lorimer and Frelich, 1994). The problem of fixating on certain states as natural was also explicitly addressed in one paper (McQuillan, 1998). Calling his stance poststructuralist (i.e., an American philosophical current based on mainly French postwar philosophy), the author enrolled an entire philosophical canon from Immanuel Kant to Jacques Derrida to attack notions of “naïve” objectivity and essentialism. The center of his attention was, in accordance with poststructuralist premises, language as a determinant of reality: “ecologists and restorers” were making “up ‘nature’” when describing it (McQuillan, 1998, p. 31). He did advocate ecological restoration but, as it was “easily confused with essentialist reification of nature,” he advised restorers to be cautious when “speaking of originality” (McQuillan, 1998, p. 31). As mentioned, contemporary ecologists also criticized the concepts of naturalness and originality.

Second, when directing their gaze towards more recent pasts, foresters were primarily concerned with the same sustainable development problems as were ecologists. The impact of policy changes such as the introduction of ecosystem management was thus important. For instance, in a paper on habitat restoration, one forester associated his task with the legislative reconsideration of “wildlife habitat protections” and “endangered species” (Haight, 1996, p. 4). Another forester analyzed Native American forest use, arguing in relation to, among other things, forest restoration that “forest managers” “must recognize the tribes' traditional and cultural connections to” the forests (Miller, 1997, p. 25). Even the old venture of yield-oriented forest restoration was framed by the historical development of problems other than low productivity, such as the degradation of wildlife habitats (e.g., Rochelle et al., 1992).

In a sense, the foresters looked to the same future as did the ecologists. The *Journal of Forestry* was indeed a bastion for scientists viewing the forest as mainly a means to an economic end. Still, when talking about the practice of forest restoration as distinct from, say, forest management, the foresters mostly thought about other aspects of the future than the economy, such as environmental problems and social considerations (e.g., Covington and Moore, 1994; Covington et al., 1997; Haight, 1996; Lippke and Fretwell, 1997; Miller, 1997; Swanson, 1994). In addition, as mentioned, when addressing the old venture of yield-oriented forest restoration, other restoration goals besides profit were emphasized as well.

In the 1990s' *Journal of Forestry*, the word “restoration,” alongside words such as “disturbance,” was used in ways similar to those in *Restoration Ecology*. Most foresters discussing conservation-oriented forest restoration, however, addressed “restoration” as an adaptation to new environment and forestry policies rather than as a goal independent of forest yield, as was the case in *Restoration Ecology*. The word “restoration” was thus linked to the political program of ecological restoration, but also treated as a response to the policy changes following the 1990s' forest debates.

## 5. Concluding discussion

Deepening previous research on the history of US land use, we suggest that the forest restoration concept in the USA developed along the following lines: Forest restoration of the 1940s was, among both ecologists and foresters, a venture oriented towards efficient, economic, and enduring resource use, i.e., what is captured by the goal of sustainable yield. The concept of forest restoration was thus primarily, but not exclusively, invoked in response to land management challenges such as high wood demands during World War II and the postwar industrial boom. It was not, it seems, the main concern of those engaged in safeguarding wilderness and similar values. Still, foresters and ecologists did not relate to forest restoration in the same way. Whereas both groups associated the concept with an established political discourse of forest restoration as a means to protect the future of the nation, ecologists did so to a much lesser extent. While ecologists sought professional legitimacy in different forms of efficient land management, forest restoration does not seem to have figured prominently in them.

In contrast to the 1940s, forest restoration of the 1990s seems to have been oriented towards conservation, environmental protection, and sustainable development among both ecologists and foresters. Ecologists and foresters accordingly seem to have used the concept of forest restoration primarily in response to environmental rather than economic challenges. Given the polarized conflicts about forestry and old-growth during the 1990s, we interpret this similarity as a sign of terminological rather than disciplinary conformity. Ecologists and foresters shared an understanding of the term “forest restoration” but stood far apart in other matters. Moreover, ecologists treated restoration as a conservation-oriented enterprise per se, while foresters, in addition to such an approach, also included economic restoration. These conclusions are drawn from a limited material, and an extended analysis of, for instance, other journals and periods or individual forest restorers would deepen and nuance our findings.

Viewing our conclusions through the lens of sociotechnical imaginaries, we highlight yet another aspect of US forest restoration. We argue that a sociotechnical imaginary connecting forest restoration to *societal progress* motivated the ecologists and foresters of the 1940s. Besides our empirical analysis, this interpretation is supported by the fact that science and technology were frequently heralded as means to advance society forward in the land use debates of the 1940s and 1950s (Worster, 1994). Of course, differences existed between ecologists and foresters in this respect as well. For example, foresters focused exclusively on forests, while ecologists were engaged with several other issues as well. Given the historical context of the 1940s, we additionally argue that the sociotechnical imaginary of progress in forest restoration was the result of a notion of crisis. Ecologists and foresters had experience of serious land use problems, such as dust storms and heavy logging, as well as major societal emergencies, such as World War II and the Great Depression, and were, as professionals, troubled by them.

Unlike during the 1940s, the ecologists and foresters of the 1990s were, as a group, more riven. We argue that their interpretations of forest restoration were still motivated by a sociotechnical imaginary of progress. However, we also contend that this imaginary was dominated by another sociotechnical imaginary, which connected forest restoration to the task of *alleviating society's impacts*. The first imaginary implied the forest conceptualized as a *cropping system* that could and should be used as means to expand and improve society. The latter imaginary instead implied a need to mitigate society's imprint on the forest, understood as a *biological system*, to avoid environmental problems. The imaginary connected to the task of alleviating society's impact was, like the imaginary of progress, also a product of a notion of crisis. Our interpretation of the latter imaginary is, besides our empirical analysis, supported by the fact that the 1990s' saw environmental concerns being attached to the global political agenda. Indeed, global political concerns had roots further back in history (Sörliin, 2013). However, they were now definitely lifted from the context of grassroots activism.

A number of forest restoration features can be stressed based on these conclusions. First, in comparison with, say, “forest management,” the concept of forest restoration seems to be open and inclusive. It is therefore sensitive to societal shifts and likely to change, sometimes fundamentally, when political priorities, expectations of forestland, and, not least, valuations of pasts and futures change. Second, the concept of forest restoration seems to be feeding on idealizations of the past. For instance, a critical mass of the analyzed papers from both the 1940s and 1990s described pre-Columbian forests, prairies, and other landscapes positively as “original” or “natural.” The 1940s' ecologists and foresters emphasized pre-Columbian lands in relation to land use issues such as dust storms, heavy logging, and over-grazing likely to cause problems in land management. Lands before 1492 thus, it seems, represented original or natural levels of productivity. Moreover, knowledge of such a state tended to function as a means to determine forest potential rather than to formulate the goal of forest restoration. The 1990s' ecologists and foresters stressed the same lands, but in the shadow of environmental problems such as the loss of wildlife habitats. Now, the pre-Columbian states, it seems, represented natural ecosystem health, balanced plant and animal populations, ecosystem functions, and the like. Pre-Columbian states were also, more often than not, the goal of forest restoration.

We believe that future research into forest restoration will continue to benefit from comparing different types of forest restoration. However, doing so, it is crucial to recognize the role of *idealized past states*, i.e., those features that forest restorers aim to bring back. Several researchers have indeed addressed restorers' often normative view of pasts, not seldom critically (e.g., Choi, 2007; Cronon, 1996; Davis, 2000; Jørgensen, 2015; Keulartz, 2016; Ladle et al., 2011; Langston, 2006; Rohwer and Marris, 2016; Smout, 2010). Their focus, however, has primarily been on the discipline of restoration ecology, the practice of ecological restoration, and approaches to past “originality,” “naturalness,” or “wilderness.” Anthropogenic climate change has intensified this debate by adding factors such as the diminishing bases from which to isolate, restore, and preserve human-free or nature-like environments (e.g., Corlett, 2016; Hirsch and Long, 2020; Seastedt et al., 2008). Instead, research systematically comparing idealized pasts of conservation-oriented and yield-oriented ventures, in different times and places, has potential to understand forest restoration as a broader societal phenomenon. How is the past state that is appealing to the yield-oriented restorer similar to or different from the past that is appealing to the conservation-minded restorer? How is the past baseline defined? What means and criteria are being used? How has idealized pasts of forest restorers fluctuated over time and space? Ultimately, the exposition of different quests for intrinsic, authentic, and other conditions for determine the “right” features of the land will help us gain a better understanding of how and why the past are being used as blueprint for future forestlands.

### CRedit authorship contribution statement

Jönsson collected and analyzed the data. Jönsson, Priebe, and Måråld developed the methodology. Jönsson and Priebe contextualized the data. Jönsson wrote the manuscript with contributions from Priebe, Måråld, and Lundmark. Jönsson, Priebe, Måråld, and Lundmark conceptualized the study.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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