Forests, Data, and Power: Mechanisms of Translation in the EU's Twin Transition

Jedrzej Niklas

Institute of Philosophy and Sociology of the Polish Academy of Sciences

Abstract
This paper explores how the European Union's (EU) twin transition—merging digital innovation with environmental sustainability—manifests in the context of forest governance. Using the European Forest Monitoring Law (EFM) as a case study, this research applies the frameworks of policy translation and data politics to investigate how digital infrastructures reshape environmental policies. Through a qualitative analysis of public consultation submissions, interviews, and participatory workshops, the study identifies three mechanisms—representation, re-articulation, and alignment—by which environmental phenomena are transformed into digital governance. Key tensions emerge, particularly around whose interests are prioritized in the representation of forests, the control over data governance, and the integration of ecological values within the digital economy. Findings reveal how the EFM's digitalization process creates new spaces for contestation, challenging the narrative of technocratic depoliticization. The paper concludes by reflecting on the broader implications of these findings for the EU's twin transition, arguing that digital technologies do not merely manage environmental governance but actively reshape it, embedding competing interests and power dynamics within these technical processes.

Keywords: *Twin Transition, Environmental Governance, Digital Technologie, Forest Monitoring, Policy Translation*

Introduction

The European Union's (EU) ambition to align environmental sustainability with technological advancement through the "twin transition" has generated both optimism and concern. While the European Green Deal (EGD) and digital transformation were initially distinct, they are now being presented as part of one modernisation agenda. However, integrating green and digital goals is far from straightforward. The tension between sustainability and technological ambition often reveals deeper contradictions, particularly as the EU navigates the complexities of environmental governance and digital innovation (Kovacic et al., 2024).

This dynamic raises questions about how these policies are being translated into practice, especially when conflicts emerge between different policy domains. Although much has been written about the ideological foundations of the twin transition, there has been less analysis of its operationalisation (Kovacic et al., 2024; Lenz, 2022). This article seeks to address this gap by examining the discussion around proposal for European Forest Monitoring Law (EFM), a case where green and digital policies are actively being integrated. Forestry, traditionally under national jurisdiction, now faces increased political pressure due to its role in both environmental protection and data governance (Blicharska & Van Herzele, 2015; Gabrys et al., 2022; Rantala et al., 2020).

Thus, the goal of this article is to explore how the connection between green and digital initiatives is being established within the twin transition framework using the EFM as a case study, and to identify the mechanisms that allow these connections to materialise. By drawing on the frameworks of policy translation and data politics, the article examines how environmental and digital goals are interwoven, what values are at stake, and how these processes shape governance. In analysing the mechanisms—representation, re-articulation, and alignment—this study demonstrates how the twin transition moves beyond mere policy implementation to actively redefine environmental governance through technological means. This work not only contributes to the understanding of the twin transition but also reflects on the broader implications of integrating digital governance within the environmental realm.

In the sections that follow, the article first analyses the European Green Deal (EGD) and its connections to forest governance, particularly through the European Forest Strategy and the newly introduced European Forest Monitoring Law (EFM). A conceptual framework is then developed to analyse how green and digital objectives are intertwined,

using the lens of policy translation and data politics. This framework allows for an examination of the empirical data through three key mechanisms of translation—representation, re-articulation, and alignment—each illustrating how environmental goals are integrated into digital governance structures, while revealing the tensions and negotiations involved in this process. The article concludes by demonstrating how the twin transition actively reshapes environmental governance through digital infrastructures, revealing that these processes are not merely technocratic but deeply political, as they involve contested priorities and the redefinition of power in both environmental and digital domains.

European Green Deal , forest policies and twinning problem

The European Green Deal (EGD) has been heralded as the first public, state-led effort to achieve climate neutrality (Vela Almeida et al., 2023). Aiming for a 55% reduction in greenhouse gas emissions by 2030 and full climate neutrality by 2050, the EGD presents the EU as a global leader in green and economic transformation. Branded as "Europe's structural response and new growth strategy"(European Commission, 2019), it promises to decouple economic growth from ecological damage through measures targeting decarbonisation, resource efficiency, and the development of a circular economy (Sikora, 2021). Yet, this optimistic vision has encountered growing criticism. Scholars point out that the EGD, while appearing to pioneer a sustainable future, perpetuates Europe's historical patterns of resource extraction, externalising environmental costs and creating "green sacrifice zones" beyond the EU's borders (Vela Almeida et al., 2023).

As part of its green agenda, the EU has rolled out several forest governance initiatives, including the European Forest Strategy for 2030(European Commission, 2021; Gordeeva et al., 2022). This strategy aims to balance forest conservation with sustainable economic activities. Yet, forest policy has long been a battleground of competing interests within the EU, especially since there is no common legally binding forest policy (Elomina & Pülzl, 2021; Lindner et al., 2014; Sotirov & Arts, 2018). Traditionally, forest governance has been shaped by voluntary agreements such as the Ministerial Conference on the Protection of Forests in Europe, which reflects a tension between maintaining national sovereignty and pushing for greater EU coordination (Sergent et al., 2018). Conflicts have emerged over the balance between forest production, conservation, and the degree of EU control

(Blicharska & Van Herzele, 2015; Elomina & Pülzl, 2021). These issues have intensified with the introduction of new policies under the EGD. As a result, forest policy continues to be a politically charged arena, where national interests, environmental goals, and economic priorities frequently clash.

Similarly, the EU's digital transformation strategy presents its own challenges. Marketed as a pathway for Europe to take a leading role in global digital innovation, the strategy promises ethical AI regulation, robust data privacy laws, and the development of digital infrastructures (Niklas & Dencik, 2020). Critics, however, argue that while the EU frames its digital agenda as an ethical governance model, the underlying emphasis on market-driven competition and technological dominance calls into question the inclusivity and democratic nature of these developments (Krarup & Horst, 2023; Niklas & Dencik, 2024). Over time, the EGD and digital transformation have coalesced into the "twin transition," a concept representing the fusion of environmental and digital agendas within the EU's broader modernisation efforts (Muench et al., 2022). This merging of priorities has now moved beyond rhetoric to series of policies, research investments, and strategic initiatives, with material effects (European Commission, 2022). This shift from storytelling to the practical development of policies introduces new dynamics and tensions that require scrutiny (Kovacic et al., 2024). For instance, the European Climate Law uses satellite data to monitor climate target compliance, while the Farm to Fork Strategy applies digital tools to increase transparency in food production chains. Yet, these initiatives not only reflect evolving governance structures but also the contestation over power, resources, and interests. The integration of digital and environmental goals continues to raise critical questions about the true costs and beneficiaries of this shift.

While the twin transition offers an appealing vision of EU modernization, it has drawn significant critical scrutiny, much of which echoes earlier concerns about the relationship between digital technologies and environmental governance. One line of criticism views the twin transition as a continuation of the discourse of ecological modernization, where technological solutions are prioritized as the primary means of addressing environmental challenges (Ewing, 2017). This critique builds on existing debates around the risks of over-relying on technology, arguing that this approach tends to oversimplify complex socio-ecological issues and overlooks the broader systemic transformations needed for genuine sustainability (Huesemann & Huesemann, 2011).

A second line of critique focuses on how the twin transition has become a powerful discursive tool that allows policymakers to frame modern challenges as manageable within existing political and economic systems (Braun & Kropp, 2023; Kovacic et al., 2024). This is linked to previous critiques of technocratic governance, where the framing of complex issues in technical terms leads to the depoliticization of inherently political decisions (Dencik, 2018). By emphasizing specific technologies and tools, the contentious and value-laden aspects of these policies are often overshadowed. This is particularly evident in debates on quantification in environmental governance, where the reduction of socio-political issues to quantifiable data points serves to simplify narratives and obscure the underlying values and conflicts inherent in policy decisions (Bauer, 2024; Bowker, 2000; Gabrys et al., 2022; Westerlaken, 2024). A third line of critique addresses the contradictions inherent in aligning digital and environmental goals (Sanchez & Nocentini Gori, 2024). While the twin transition promises sustainability and technological leadership, the push for digital sovereignty, aimed at reducing reliance on non-European technologies, has led to increased resource extraction and local environmental degradation. This contradiction highlights the unintended consequences of integrating digital and environmental policies, raising questions about whose interests are being prioritized and the true environmental costs of pursuing technological independence (Lehuedé, 2024). These critiques suggest that, while the twin transition offers a compelling narrative of progress, it also presents significant challenges. The technocratic framing of the twin transition may obscure its political dimensions, but it does not eliminate them. These issues will only become more pronounced as the EU continues to implement policies that fuse digital and green goals, making it crucial to understand the underlying tensions driving these developments.

One such policy that exemplifies these challenges is the European Forest Monitoring Law (EFM) (European Commission, 2023). Introduced in 2023 as part of the European Forest Strategy and EGD, the EFM addresses growing pressures on EU forests stemming from climate change, unsustainable land use, and natural disasters. The law proposes an advanced monitoring system using digital technologies, such as satellite data (via Copernicus) and on-the-ground sensors, to assess forest health, biodiversity, and risks. The proposal also mandates harmonized data collection across Member States, ensuring consistent monitoring and reporting standards. It builds on the existing Forest

Information System for Europe (FISE), expanding its role by integrating new indicators like forest connectivity and soil organic carbon. Moreover, the EFM emphasizes the importance of data interoperability, linking forest data to the EU's broader Green Data Space for environmental governance. As framed by the European Commission, the EFM exemplifies the "synergies between the green and digital transition" (European Commission, 2023).

However, as existing research on data governance in forestry has shown (Gabrys et al., 2022; Rantala et al., 2020; Urzedo et al., 2022), the integration of digital technologies into environmental management is not without its complications. Issues of control, access, and the political economy of data in forestry raise difficult questions about who benefits and who bears the costs. It is also linked to broader questions of eco-political implications of digital technologies with material struggles and problematic power imbalances (Nost & Goldstein, 2022). While the EFM is not the central policy driving the twin transition, it provides a critical lens through which to examine the operationalisation of these goals in practice. Its legislative development and the tensions that surround it offer valuable insights into the broader dynamics at play within the twin transition. To better understand these dynamics, the following section introduces the conceptual frameworks that will guide the analysis of how digital and environmental policies are translated and contested within the EFM and the broader twin transition.

Conceptual framework: policy translation and data politics

In examining the EFM and the broader twin transition, this research draws on the concepts of policy translation and data politics. As highlighted earlier, the twin transition presents contradictions and tensions, manifested in real-world policy developments. To understand how these contestations unfold and how the twin transition is operationalized, policy translation offers a compelling analytical starting point.
Rooted in Science and Technology Studies (STS), policy translation provides a lens to understand how ideas, practices, and objects shift across different domains (Callon, 1984). This process involves more than the simple transfer of policies; it entails reconfiguring ideas to fit new settings (Harman, 2009). Latour and Callon's work on

translation has been widely applied to explore how phenomena are reshaped as they move between fields, such as from science to policy (Ascui et al., 2018; Machen, 2018; Mathews, 2008).

In the context of policy studies, translation becomes an important tool for understanding how policies adapt and change as they "move" through different domains—geographical, bureaucratic, and political (Clarke et al., 2015). Policies are not simply transferred intact; they undergo rearticulation, a core concept in translation studies, where they are reshaped and combined with new political and cultural elements to fit the environments they enter. This process involves both construction and deconstruction: policies are adapted to local contexts, often realigning with new priorities, while existing connections or frameworks may be dismantled to prevent resistance or opposition. Some ideas can undergo dislocation, where established meanings, practices, and relationships are disrupted. This dislocation necessitates a subsequent reordering—a critical step in the translation process—where these elements are reassembled into a configuration that makes sense within the new setting. However, this movement is rarely smooth—conflict, contradictions, and power struggles emerge as various actors shape the direction of policies, influencing which aspects are prioritized and which are marginalized. In this contested space, certain voices or perspectives may be suppressed or silenced, particularly if they do not align with the dominant narrative or goals.

Another conceptual frame here is data politics, which provides a critical lens to understand how data has become a powerful and contested object within modern governance. Ruppert et al. (2017) emphasize that data is not just a passive representation of reality but an active force that shapes political life by generating new forms of power and governance. Data enacts the realities it measures and controls, embedding ideological choices and power dynamics within its very structure (Dencik, Hintz, et al., 2019). A closer look at data politics reveals the various ways in which data becomes a political object. First, data functions as a tool for representing ideas by transforming complex realities into simplified data points that are actionable within policy frameworks. However, these processes are far from neutral, involving deliberate choices about what to include or exclude, which shapes what is made visible and what is marginalized (Ascui et al., 2018; Dencik, Redden, et al., 2019; Redden et al., 2020). Second, data is entangled in political struggles over control and governance. The institutional architecture that

manages data flows and the authority to access and use data raise critical questions about governance and rights. Debates over data privacy, algorithmic bias, and the ethics of data surveillance illustrate how control over data becomes highly politicized. (Bakker & Ritts, 2018; Beraldo & Milan, 2019) Third, data is increasingly driven by economic pressures, becoming a commodified asset that fuels new business models. This plays out across domains like environmental management, where major tech companies influence how data is governed and utilized. These dynamics are closely linked to infrastructural considerations, as the physical and digital infrastructures that enable data circulation often prioritize the interests of those in control, directly impacting how policies like the EFM are implemented (Dencik, 2022; Viljoen, 2020).

Combining policy translation and data politics provides a framework to understand how digital and environmental policies are connected and contested in the EU's twin transition. Policy translation explains how ideas move and adapt across domains, showing that digital innovation reshapes and interacts with sustainability to create hybrid frameworks. Data politics situates this translation within broader tensions and power struggles, highlighting how data represents specific problems and acts as a tool of governance. By framing environmental phenomena through data, technologies shape what is visible, what is prioritized, and who benefits. These frameworks help identify the mechanisms—such as representation, control, and re-articulation—that materialize through the process of translating environmental policies into data policies. Together, they allow us to examine how digital technologies not only implement but also transform environmental policies, revealing the underlying politics and power relations that shape the twin transition.

Research methods

This study examines how the connection between green and digital initiatives is operationalized in the European Union's twin transition framework, using the EFM as a case study. The research employed a combination of qualitative methods to provide a comprehensive understanding of the EFM's legislative development and the tensions surrounding it. The core methods included document analysis, semi-structured

interviews, and a participatory workshop. The document analysis (Bowen, 2009) covered key preparatory materials, including the impact assessment, legislative proposal, working documents, and official reports, as well as speeches from EU officials (totally 20 documents). This analysis helped to uncover how digital and environmental objectives are framed and integrated within the legislative process.

The research also draws on two rounds of public consultations conducted in 2021 and 2023. These consultations invited feedback from various stakeholders—NGOs, , businesses, and academics—via online questionnaires and written submissions (policy briefs, papers, etc.). Public consultations are intended to democratize policy-making by incorporating civil society perspectives and increasing the legitimacy of decisions (Rasmussen & Toshkov, 2013). However, they are also critiqued for favoring particular groups with specialized expertise, limiting the inclusivity of the process (Persson, 2007). The public consultation process generated two types of content: (a) answers to an online questionnaire, and (b) policy papers, briefs, and additional materials attached to the submissions. All contributions were published on the official EU webpage. By analyzing these submissions, this study seeks to understand the different values, priorities, and narratives articulated by various stakeholders in relation to the EFM. The variety of actors submitting responses—ranging from environmental NGOs to tech firms—offers a rich opportunity to explore the tensions and conflicts that arise in the negotiation of digital and environmental policy goals.

For the qualitative analysis, I examined all contributions from the public consultations that included more than answers to the standard questionnaire. From the first round, 50 documents were analysed, and from the second round, 42 documents, varying in length from 1 to 16 pages. Later in the text, I refer to examples of these submissions using the acronym of the organization that was represented, with acronyms of the referred publications listed in Table 1. This selection focused on materials such as policy briefs, papers, and other documents where stakeholders had the opportunity to formulate their ideas in their own language, providing a richer and more detailed articulation of their positions. These submissions allowed to explore how different actors—from environmental NGOs to industry representatives—framed their concerns, priorities, and values around the EFM, particularly in relation to issues of sovereignty, marketization, and ecological integrity

Table 1 Acronyms of Organizations and Referred Publications from Public Consultation Submissions

Organisation	Acronym	Type
1. European State Forest Association	EUSTAFOR	Forest owners
2. Confederation of European Forest Owners	CEFO	Forest owners
3. European Agroforestry Federation	EAF	Forest owners
4. Central Union of Agricultural Producers and Forest Owners	MTK	Forest owners
5. ClientEarth	CE	Environmental NGO
6. World Wildlife Fund	WWF	Environmental NGO
7. Fern	FR	Environmental NGO
8. Protect the Forest Sweden	PFS	Environmental NGO
9. Citiznes and Forests	CF	Environmental NGO
10. Stora Enso	SE	Other businesses
11. European Association of Remote Sensing Companies	EARSC	Other businesses
12. Confederation of European Paper Industries	CEPI	Other businesses
13. Planet Labs	PL	Other businesses

In addition to the document analysis, five semi-structured interviews were conducted to complement the research and provide further context to the findings (Int. 1-5). These interviewees were carefully selected after the initial document analysis was completed, based on their direct involvement in the development of the EFM proposal. The interviewees included a representative from the European Commission responsible for drafting the proposal, a European organization representing forest owners, two environmental organizations engaged in environmental activism, and a forestry expert from a Member State working group involved in shaping the proposal. These interviews were designed to gain insight into each interviewee's specific role in the legislative

process, as well as their views on how the work on the EFM unfolded. The questions focused on identifying key challenges and concerns surrounding the law, especially in relation to the political dynamics and tensions between EU-level harmonization and Member State sovereignty. Given the limited number of interviews, they were used as complementary sources of insight to enrich the document analysis and public consultation findings, helping to contextualize and deepen the understanding of the legislative and political processes surrounding the EFM.

Additionally, a two-hour participatory workshop with 35 environmental activists was held at the European Forests Activists Summit in May 2023 (later Workshop notes, 2023). This workshop, initiated at the invitation of the event organizers, aimed to facilitate broader discussions on the role of digital technologies in forest governance. The participants represented a range of activist organizations, and the session was designed to raise general questions about how activists perceive the impact of digital technologies on environmental management. The format encouraged an open exchange of views on both the benefits and challenges of these technologies. While EFM was not the initial focus of the workshop, its significance in the broader context of the EU's twin transition soon emerged as a central topic of discussion. As activists reflected on their experiences with forest governance, the upcoming EFM proposal became a natural focal point of debate.

To analyse the documents, interview data, and notes from the workshop, this article followed Redden's methods of document analysis, which are particularly suited for examining socio-technical systems in public sector policy-making (Redden, 2018). I developed a coding framework based on critical questions that guided the analysis, focusing on three key areas (Table 2). This structured approach aimed to capture how different actors influenced these discussions, what tensions arose, and how forest data was framed within the policy. By applying this structured yet flexible framework, the analysis brought to light critical tensions, power dynamics, and conflicts that reveal the broader role of the EFM within the EU's twin transition. With this conceptual and methodological approach in place, we now turn to the presentation of the findings.

Table 2 Document analysis questions

How is environmental data represented in the policy documents and consultation submissions?
What conflicts or tensions are articulated around the control and use of environmental data?
How are environmental and economic goals aligned or contested in the documents?
What are the policy priorities and values highlighted by different stakeholders?
How are the roles of digital technologies framed in relation to environmental governance?

Understanding mechanisms of translation

In this section, the focus shifts to an empirical analysis of how the twin transition between environmental and digital governance is operationalized through the EFM. Building on the conceptual framework, this analysis explores how environmental objectives are translated into digital infrastructures and made governable within the EU policy framework. The movement of policy ideas—how they are transferred across domains and reconfigured in the process—will be a key focus. The analysis identifies three core mechanisms that illustrate how these translations occur: the representation of environmental phenomena through digital technologies, the re-articulation of power and control in governance, and the alignment of often conflicting green and digital policy goals (summary in Table 3).

Representation: Translating Environmental Phenomena into Digital Indicators

A central theme that emerged from my analysis of the discussion around EFM is the translation of complex forest ecosystems into standardised, digital indicators. This is not a neutral technical process but a politically charged one, involving decisions on what aspects of forests to measure and how to measure them (Ascui et al., 2018; Westerlaken, 2024). It reflects the broader challenge of environmental governance: reducing ecological

complexity to quantifiable data points for systematic monitoring. The first mechanism of translation, therefore, is *representation*, which involves translating multifaceted forest dynamics into standardized data that can align with the EC objectives, enabling the consistent monitoring of forest health, biodiversity, and ecosystem services across the EU.

Findings from the document analysis and interviews indicate that the selection of indicators such as tree cover density and defoliation, primarily measured through satellite data and in-situ observations, reflects the political priorities embedded within the European Forest Monitoring Law (EFM). These indicators align closely with EU climate goals, particularly those tied to the LULUCF Regulation and the Biodiversity Strategy for 2030. As one forestry expert highlighted, "*In these big new proposals about forestry, there's always this crucial choice of what to measure. It's not always straightforward… you have to select, and in doing so, you also need to consider the other policies the EU has already pushed for*" (Int. 2). This emphasizes how technical decisions on what to measure are shaped by broader political imperatives, privileging certain ecological aspects while excluding others.

The role of experts in this process is critical, as they bridge scientific knowledge and policy priorities. One Interviewee explained, "*In deciding what to measure, you need to be scientific and rely on the long-standing knowledge of scientists—that's why these expert groups are so important*" (Int. 1). The involvement of experts helps legitimize these decisions, embedding them within established international frameworks. However, this collaboration also reflects how political considerations infiltrate scientific decision-making. The EC's technical workshops, while ostensibly about ensuring accuracy and relevance, are part of a broader effort to align ecological monitoring with harmonization goals that serve EU-wide political objectives, balancing complexity with bureaucratic standardization (European Commission. Directorate General for Environment., 2023).

The decision to prioritize certain indicators, such as carbon sequestration, is not without consequence. Experts pointed out that the abstraction of complex forest ecosystems into standardized data points risks oversimplifying the ecological realities on the ground. One participant noted, "*International indicators don't capture everything; it's about making*

decisions on what is feasible to monitor" (Int. 2). This process of simplification leaves out important ecological factors, such as species diversity and ecosystem connectivity, reflecting a prioritization of carbon markets over biodiversity concerns. Environmental organizations involved in public consultations echoed these concerns, advocating for broader sets of indicators that would capture a more holistic picture of forest ecosystems (CE, WWF). They called for the inclusion of metrics that track forest management practices and the condition of old-growth forests, emphasizing that the current framework risks overlooking crucial ecological processes (WWF, FR, Int 4). The demand for additional indicators—such as soil organic carbon, old-growth forest health, and ecosystem services like forest connectivity—was not just a call for more data but a push to reshape how forests are valued in policy (WWF, FR). They argued that without these comprehensive measures, the social and ecological functions of forests, particularly in terms of their role in biodiversity protection and local livelihoods, would be neglected in favour of narrower, market-driven objectives (FR). Activists highlighted the misalignment of current tools, which might fail to fully capture the value of diverse forest ecosystems, particularly old-growth forests (Workshop notes). Furthermore, activists critiqued the oversimplification of complex ecological data, arguing that digital technologies risk reducing intricate forest dynamics to inadequate indicators, leading to misinformed strategies (Workshop notes). However, there was also support for using technology to enhance biodiversity conservation efforts, and mapping technologies could help identify and protect critical (Workshop notes).

In contrast, forest and landowner groups expressed concerns about the practical and economic challenges posed by the EFM's data collection system (EUSTAFOR, CEFO, Int. 3). They argued that the complexity and costs of the proposed system, particularly its reliance on satellite data, would place undue financial burdens on forest owners and potentially overlook crucial local forest characteristics such as timber stock and tree height (EAF, EUSTAFOR, MTK). This scepticism underscores a broader political tension between the EU's goal of harmonizing forest monitoring practices and the need for locally adapted management methods. Forest owners argued for the continued use of traditional, regionally specific methods that they believed were more reliable and reflective of the unique ecosystems they manage (EUSTAFOR, EAF, CEFO).

This divergence in perspectives underscores the tension between the EU's push for standardized, scalable digital monitoring systems and the practical concerns of forest owners. While the EU seeks consistency across Member States, forest owners argued that a one-size-fits-all approach could undermine their ability to manage forests based on local needs. The representation mechanism in the EFM framework therefore highlights a broader political negotiation over whose priorities are being served. This raises critical questions about the political priorities embedded in these processes, as the EU's focus on standardized data ultimately shapes not only forest governance but also whose interests are prioritized in decision-making.

Re-articulation of Power: Formulating Control Over Data

Another important subject in the analysis was the issue of control over data—its governance, sharing, and use—reflecting broader concerns about power in environmental governance and data infrastructures. Interviewees highlighted that this issue was one of the most contentious aspects of the EFM framework, facing significant resistance from various stakeholders. The re-articulation of power within this framework illustrates how decisions about data governance are central to shaping forest management policies. This mechanism exposes the tension between the EU's push for centralized control over data and Member States' efforts to retain autonomy.

At the heart of the EFM proposal are standardization and harmonization, which serve as tools to centralize how forest data is collected and managed (European Commission, 2023, 2023). As one interviewees explained, *"The question of what to standardize and what to harmonize is a big deal... A lot of consideration went into this—balancing consistency and flexibility"* (Int 1). Standardization, driven by digital technologies like the Copernicus satellite system, seeks to impose uniform data collection methods across MS, enabling centralized monitoring. In contrast, harmonization offers more flexibility, allowing national practices to align with EU frameworks without full standardization. This flexibility, however, introduces inconsistencies in data quality, reflecting deeper tensions between the EU's goals for uniform governance and national sovereignty. This tension is clearly reflected in the policy options outlined in the EFM's impact assessment

document: one favoring voluntary harmonization and another proposing legislative standardization (European Commission, 2023). The latter, while ensuring consistency, would limit national flexibility and control over forest management. This reflects the broader friction between the EU's push for data-driven governance of natural resources and the resistance from MS seeking to maintain sovereignty over their forest management systems.

Public consultations also highlighted sovereignty concerns, with national governments framing the EU's data protocols as overreach. Forest owners and local management organizations argued that the EU's framework was overly complex, costly, and a threat to regionally adapted practices (EUSTAFOR, MTK). The most contentious issue was geolocated data, which forest owners argued would expose sensitive business information (CEFO). As one interviewee noted, "*Negotiations around data governance were very complex, but we came up with some new data governance mechanism*" (Int. 1). This resistance reveals how control over digital information becomes intertwined with control over physical land and natural resources. Interestingly, many forest owners organisations framed their opposition in the language of privacy—commonly associated with digital governance (CEFO, MTK, EAF). They raised concerns that sharing geospatial data would undermine competitive business practices and reduce their control over land management. Privacy became a tool to assert control over the economic value of forests and the information that governs them.

In contrast, environmental NGOs welcomed the EU's intervention. They viewed the EFM as an opportunity to increase transparency and hold national institutions accountable (PFS, CF, and Int 4). For these groups, the EU's framework provided a way to ensure better oversight of forest management practices, particularly in contexts where local systems were deemed opaque. This alignment between environmental organizations and EU institutions reflects a shift in environmental governance, where data governance is not just about transparency but about realigning power dynamics within the forestry sector. Concerns raised during the workshop emphasized the risks of corporate data ownership, particularly over smallholder or indigenous lands, and the potential for exploitation. Participants also highlighted the dangers of centralizing data control in the hands of a few entities, warning that this could lead to misuse and a lack of transparency in forest governance. (Workshop notes)

The re-articulation of power in the EFM framework shows how control over data has become a means of controlling natural resources. As environmental governance becomes increasingly digital, control over data flows shapes how forests are managed, reflecting the competing interests of different actors vying for influence in this new digital-environmental space.

Alignment of Goals: Merging Environmental and Digital Agendas

The third mechanism of translation observed in the EFM framework is alignment, where environmental objectives are integrated with broader digital and economic agendas. This framing positions forest governance within the EU's digital transformation. As one interviewee noted, while this alignment "*might not have been the most critical aspect for all stakeholders, it was crucial for the EU's strategic imperatives*" (Int 1). Forests are no longer seen merely as natural resources but as elements of the digital economy.

A central aspect of this alignment is the connection between the EFM and existing EU digital policies including Digital Agenda, and Drone Strategy 2.0. The proposal emphasizes open data and interoperability, referencing Directive (EU) 2019/1024 on public sector data sharing and contributing to the Green Data Space (European Commission, 2023). These links illustrate the EFM's role in building a digitally integrated governance system. The EFM is also presented as a tool for economic growth. By standardizing data across nearly half the EU's land area, the framework is expected to create business opportunities in sectors such as remote sensing and data processing. According to the EFM's impact assessment, the global market for remote sensing products could reach USD 55.5 billion by 2028, with European businesses playing a major role. Small and medium-sized enterprises are seen as potential beneficiaries of these new data-driven markets, particularly those involved in forest management and timber production.

Additionally, the EFM's alignment with the digital business agenda offers opportunities for tech companies and forest owners. Remote sensing technologies are projected to improve timber production and forest management, leading to higher yields and better-quality timber (European Commission. Directorate General for Environment., 2023). The

potential for forest data to feed into the carbon offset market also promises new revenue streams for forest owners engaged in carbon capture projects. This illustrates how the EU is positioning forests as economic assets within the emerging data economy.

Tech companies, particularly those in Earth observation and remote sensing, were active in public consultations (EARSC, PL). They advocated for increased monitoring frequency and the inclusion of Very High-Resolution (VHR) satellite data to better detect illegal logging and environmental risks. These companies pushed for commercial services to fill gaps in public systems like Copernicus, emphasizing the need for the EFM framework to be responsive to technological advances and market opportunities (EARSC, PL). While environmental NGOs did not explicitly raise concerns about business and commercialization in the public consultations, these issues were addressed during the workshop. Participants voiced concerns about the privatization of data, warning that restricting access to private entities could exclude public and community stakeholders from decision-making processes. (Workshop notes)

Finally, the proposal mirrors the language of digital governance, using repeatedly terms like "accurate," "precise," and "cost-efficient" to describe digital monitoring technologies. In addition, digital technologies are framed as "cost-efficient" and "resource-efficient," emphasizing their economic benefits over traditional forest monitoring methods (European Commission, 2023, 2023). The use of terms like "real-time" and "rapid response" further underscores the immediate, dynamic capabilities of digital data, positioning it as crucial for the timely and effective management of forests. This convergence of language highlights how the EFM rearticulates forest governance in digital terms. By using the concepts of digital governance—accuracy, efficiency, and responsiveness—the proposal reinforces the integration of environmental monitoring with digital innovation and economic growth, showing how the twin transition is reshaping the way forest ecosystems are managed and valued.

Table 3: Enhancing the Comparative Table with Translation:

Feature	Representation	Re-articulation of Power	Alignment of Goals
Objective	To convert complex environmental phenomena into quantifiable data points and indicators.	To manage and regulate the power dynamics and governance structures that control data flow and use.	To integrate and align environmental policies with broader digital and economic agendas.

Primary Action	Selection and Abstraction: Choosing which aspects of the environment to represent and how to simplify them.	Authority Allocation and Enforcement: Determining who controls data standards and ensuring compliance.	Conceptual Bridging and Integration: Linking environmental goals with digital frameworks and economic strategies.
Stakeholder Involvement	Focus on **experts and data scientists** who determine how environmental data is represented and standardized.	Involves **governments, institutions, and regulatory bodies** who negotiate and enforce control over data governance.	Engages **policymakers, businesses, and strategists** who align and reframe environmental policies to fit digital agendas.
Power Dynamics	**Influence of scientific authority**: Control over what data is selected and how it is represented.	**Governance power**: Centralization vs. decentralization, and who has the authority to set and enforce standards.	**Strategic alignment**: Power to define how environmental issues are framed within digital and economic narratives.
Challenges	**Accuracy vs. simplification**: Balancing the need for data that is both manageable and representative of complex realities.	**Sovereignty vs. standardization**: Tension between local autonomy and the need for uniform standards.	**Coherence vs. dilution**: Risk of environmental goals being overshadowed or redefined by digital and economic priorities.
Outcome	Creation of standardized data sets that may simplify or obscure certain aspects of environmental reality.	Establishment of governance frameworks that dictate how data is collected, shared, and used across different regions.	Development of integrated policies that align environmental objectives with broader digital and economic strategies.

Discussing mechanism of translation and concluding thoughts

This study provides a critical examination of how the twin transition—a key EU policy linking environmental and digital objectives—materializes through specific infrastructures and governance frameworks, using the European Forest Monitoring Law (EFM) as a case study. Moving beyond its initial framing as a visionary narrative, the twin transition now brings with it concrete material and political effects that highlight its multifaceted nature. By focusing on three mechanisms of translation—representation, re-articulation, and alignment—this research illustrates how the twin transition operates not just as a story of harmonized goals but as a socio-technical transformation with significant political and economic consequences.

This article initially highlighted the importance of movement and adaptation as central dynamics within the twin transition. In line with critical policy studies, which emphasize that studying policies is fundamentally about studying movement, this research reveals how policies like the EFM are continuously reshaped as they traverse different governance domains (Clarke et al., 2015). In this context, movement has multiple meanings—it refers not only to the shift between governance scales, from the EU level to local implementation, but also to the movement between digital and environmental spheres. As policies transition between these domains, they encounter diverse actors, institutional structures, and political agendas, leading to reconfigurations that often alter their original intent. Although geographic movement—particularly when MS interpret and implement EC directives—is significant, this study primarily focuses on how digital and environmental policies are continuously adapted and rearticulated as they are integrated.

A key insight from this research is how policy translation within the twin transition leads to the redefinition of traditional concepts. As they move, policies pick up new elements, lose others, and are rearticulated to align with shifting power dynamics and agendas. This fluidity introduces unpredictability, as each movement sparks rethinking and renegotiation. For instance, privacy, typically framed as a tool for individual rights, gains new significance in forest governance, where it is used by forest owners to protect economic interests. This appropriation of privacy language parallels how corporations, like Apple and Uber, have utilized privacy rhetoric not to defend individual freedoms, but to reinforce their own control over data and markets. As Weinberg argues, 'corporate defenses of privacy rights serve as forms of instrumental corporate social responsibility... framing themselves as defenders of user privacy, despite the fact that it is in their commercial interests to do so' (Weinberg, 2017). In the context of forestry, privacy is invoked to safeguard business interests rather than individual rights. Similarly, environmental data, once seen as a tool for ecological monitoring, is now increasingly recognized as an asset within the EU's digital strategies. The commercialization of data through initiatives like the Green Data Space positions environmental data within broader economic frameworks, shifting its purpose from preserving ecological integrity to generating economic value. Furthermore, data standards in EFM means a negotiation between the EU and MS, where tensions over sovereignty are mediated. These

redefinitions place these concepts within new power configurations, where both economic and political interests shape their roles in governance.

While this article has focused on the concept of movement and how it redefines key ideas, I also sought to capture a deeper understanding of how this movement is carried out—what specific operations are involved, who engages in them, and how different actors participate in these processes. The movement of policies within the twin transition is not uniform; it takes on different meanings and positions depending on the actors and contexts involved (Kovacic et al., 2024; Sanchez & Nocentini Gori, 2024). To explore this more thoroughly, I proposed focusing on particular mechanisms of translation that reflect long-standing problems identified in the literature. These mechanisms—though not entirely new—when considered together provide a clearer picture of the multiple dimensions of the twin transition. This focus allows us to see that movement itself has distinct faces, and my contribution to this discussion is not only about movement but about how this movement manifests in particular ways.

By analyzing these mechanisms, the study highlights how digital and environmental policies not only coexist but transform one another. This combination of digital and green policies, as shown throughout this study, often results in conflicting goals, revealing the complex dynamics driving the twin transition (Sanchez & Nocentini Gori, 2024). Representation captures how abstract concepts like biodiversity are converted into quantifiable data, creating indicators that can be managed within digital infrastructures. Re-articulation focuses on how integrating digital and environmental policies reconfigures governance, often leading to competing purposes. Alignment explains how environmental data becomes embedded within broader economic and digital frameworks, shifting the focus from ecological integrity to economic value. The comparative table (Table 3) further clarifies how these mechanisms function in practice. Each mechanism offers a distinct view of the movement of policy between environmental and digital domains, illustrating the complex and sometimes contradictory goals shaping the twin transition. The table reveals the key features of each mechanism each capturing a different aspect of translation. However, it is important to recognize the limitations of this study. The EFM represents a particular piece of policy that focuses heavily on the

creation of data infrastructures and the management of environmental data. The twin transition, as a broader initiative, encompasses a wide range of sectors, including agricultural production and energy consumption. Translation processes in these areas may follow different patterns, reflecting the specific challenges and priorities in each domain.

The dynamic nature of movement within the twin transition underscores the unpredictability of outcomes. As policies move across contexts, they encounter new actors, challenges, and resistance, reshaping them in ways that often diverge from initial plans. This means that the twin transition is inherently non-linear and contingent on micro-level negotiations and adaptations. As this study shows, frictions are an important part of this adaptation (Lehuedé, 2022). The proposed mechanisms of translation—representation, re-articulation, and alignment—are helpful in illustrating the stakes involved in these frictions. Conflicts arise over how the environment is represented, with differing views on what these representations prioritize—whether it's ecological integrity or economic goals. Similarly, there are tensions over who controls environmental data and how this information is used, revealing deeper struggles around sovereignty, ownership, and the balance between local and EU-level governance. As Lehuedé (2022) points out, "environmental awareness over the environmental costs of data is an emergent phenomenon," and different grassroots mobilizations are already addressing the damage caused by data circulation, further adding to the complexity of negotiating the twin transition.

Public consultations reveal that, rather than depoliticizing governance, digitalization has created new spaces for contestation. This contrasts with discussions like Popartan et al (2022), who argues that digital technologies often works to depoliticize natural resources goverance through technical language. In the context of the EFM, however, actors have found ways to articulate their political interests through the language of data collection and governance, embedding their stakes in these technical processes. Interestingly, while significant conflicts emerge in the mechanisms of representation and re-articulation—particularly around how the environment is represented and whose priorities these representations serve—the alignment of economic goals with digital agendas has faced minimal contestation. The reasons for this lack of resistance are unclear, though it may reflect the specific nature of the policies involved. This suggests that marketization-

related issues are still being negotiated, perhaps using a different language when framed as part of the digital transition.

In summary, this study provides an lenses through which to understand the twin transition as more than a policy alignment of digital and environmental goals. By examining how translation processes operate through representation, re-articulation, and alignment, this article reveals the complex, often contested, ways in which these policies are reshaped across different governance contexts. While the EFM provides a focused case study on the role of data infrastructures in forest governance, it is clear that the twin transition extends far beyond, with potentially different dynamics at play in other sectors. Moving forward, further exploration is needed to better understand how these mechanisms of translation play out across other sectors of the twin transition and how future governance frameworks might address the emerging tensions between sustainability, justice, and market-driven approaches.

Bibliography

Ascui, F., Haward, M., & Lovell, H. (2018). Salmon, sensors, and translation: The agency of Big Data in environmental governance. *Environment and Planning D: Society and Space*, *36*(5), 905–925. https://doi.org/10.1177/0263775818766892

Bakker, K., & Ritts, M. (2018). Smart Earth: A meta-review and implications for environmental governance. *Global Environmental Change*, *52*, 201–211. https://doi.org/10.1016/j.gloenvcha.2018.07.011

Bauer, S. (2024). Seeing Like a Model Fish: How Digital Extractions Mediate Metabolic Relations. *Science, Technology, & Human Values*, *49*(3), 524–554. https://doi.org/10.1177/01622439241236520

Beraldo, D., & Milan, S. (2019). From data politics to the contentious politics of data. *Big Data & Society*, *6*(2), 205395171988596. https://doi.org/10.1177/2053951719885967

Blicharska, M., & Van Herzele, A. (2015). What a forest? Whose forest? Struggles over concepts and meanings in the debate about the conservation of the Białowieża Forest in Poland. *Forest Policy and Economics*, *57*, 22–30. https://doi.org/10.1016/j.forpol.2015.04.003

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2), 27–40. https://doi.org/10.3316/QRJ0902027

Bowker, G. C. (2000). Biodiversity Datadiversity. *Social Studies of Science*, *30*(5), 643–683.

Braun, K., & Kropp, C. (2023). Building a better world? Competing promises, visions, and imaginaries-in-the-making of the digitalization of architecture and construction. *Futures*, *154*, 103262. https://doi.org/10.1016/j.futures.2023.103262

Callon, M. (1984). Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay. *The Sociological Review*, *32*(1_suppl), 196–233. https://doi.org/10.1111/j.1467-954X.1984.tb00113.x

Clarke, J., Bainton, D., Lendvai, N., & Stubbs, P. (2015). *Making policy move: Towards a politics of translation and assemblage*. Policy Press.

Dencik, L. (2018). Surveillance Realism and the Politics of Imagination: Is There No Alternative? *Krisis | Journal for Contemporary Philosophy*, *38*(1), 31–43. https://doi.org/10.21827/krisis.38.1.38829

Dencik, L. (2022). The Datafied Welfare State: A Perspective from the UK. In A. Hepp, J. Jarke, & L. Kramp (Eds.), *New Perspectives in Critical Data Studies: The Ambivalences of Data Power* (pp. 145–165). Springer International Publishing. https://doi.org/10.1007/978-3-030-96180-0_7

Dencik, L., Hintz, A., Redden, J., & Treré, E. (2019). Exploring Data Justice: Conceptions, Applications and Directions. *Information, Communication & Society*, *22*(7), 873–881. https://doi.org/10.1080/1369118X.2019.1606268

Dencik, L., Redden, J., Hintz, A., & Warne, H. (2019). *The 'golden view': Data-driven governance in the scoring society*. *8*(2), 24.

Elomina, J., & Pülzl, H. (2021). How are forests framed? An analysis of EU forest policy. *Forest Policy and Economics*, *127*, 102448. https://doi.org/10.1016/j.forpol.2021.102448

European Commission. (2019). *COMMUNICATION: The European Green Deal* (COM(2019) 640 final).

European Commission. (2021). *COMMUNICATION New EU Forest Strategy for 2030* (COM(2021) 572 final).

European Commission. (2022). *COMMUNICATION Strategic Foresight Report Twinning the green and digital transitions in the new geopolitical context* (COM(2022) 289). https://primarysources.brillonline.com/browse/human-rights-documents-online/communication-from-the-commission-to-the-european-parliament-and-the-council;hrdhrd46790058

European Commission. (2023). *IMPACT ASSESSMENT REPORT Accompanying the proposal for a Regulation on a monitoring framework for resilient European forests* (SWD(2023)).

European Commission. (2023). *REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on a monitoring framework for resilient European forests* (2023/0413 (COD)).

European Commission. Directorate General for Environment. (2023). *Support for the*

   impact assessment of the legislative proposal for a new EU framework on forest

   monitoring and strategic plans: Final report. Publications Office.

   https://data.europa.eu/doi/10.2779/229057

Ewing, J. A. (2017). Hollow Ecology: Ecological Modernization Theory and the Death of

   Nature. *Journal of World-Systems Research*, *23*(1), 126–155.

   https://doi.org/10.5195/jwsr.2017.611

Gabrys, J., Westerlaken, M., Urzedo, D., Ritts, M., & Simlai, T. (2022). Reworking the

   political in digital forests: The cosmopolitics of socio-technical worlds. *Progress*

   in Environmental Geography, *1*(1–4), 58–83.

   https://doi.org/10.1177/27539687221117836

Gordeeva, E., Weber, N., & Wolfslehner, B. (2022). The New EU Forest Strategy for

   2030—An Analysis of Major Interests. *Forests*, *13*(9), 1503.

   https://doi.org/10.3390/f13091503

Harman, G. (2009). *Prince of networks: Bruno Latour and metaphysics*. Re.press.

Huesemann, M., & Huesemann, J. (2011). *Techno-Fix: Why Technology Won't Save Us or*

   the Environment. New Society Publishers, Limited.

Kovacic, Z., García Casañas, C., Argüelles, L., Yáñez Serrano, P., Ribera-Fumaz, R.,

   Prause, L., & March, H. (2024). The twin green and digital transition: High-level

   policy or science fiction? *Environment and Planning E: Nature and Space*,

   25148486241258046. https://doi.org/10.1177/25148486241258046

Krarup, T., & Horst, M. (2023). European artificial intelligence policy as digital single

   market making. *Big Data & Society*, *10*(1), 205395172311538.

   https://doi.org/10.1177/20539517231153811

Lehuedé, S. (2022). When friction becomes the norm: Antagonism, discourse and planetary data turbulence. *New Media*, 16.

Lehuedé, S. (2024). An elemental ethics for artificial intelligence: Water as resistance within AI's value chain. *AI & SOCIETY*. https://doi.org/10.1007/s00146-024-01922-2

Lenz, S. (2022). The digital spirit of green capitalism. How the European Union tries to save ecological modernisation. *Culture, Practice & Europeanization*, *7*(2), 166–191. https://doi.org/10.5771/2566-7742-2022-2-166

Lindner, M., Fitzgerald, J. B., Zimmermann, N. E., Reyer, C., Delzon, S., Van Der Maaten, E., Schelhaas, M.-J., Lasch, P., Eggers, J., Van Der Maaten-Theunissen, M., Suckow, F., Psomas, A., Poulter, B., & Hanewinkel, M. (2014). Climate change and European forests: What do we know, what are the uncertainties, and what are the implications for forest management? *Journal of Environmental Management*, *146*, 69–83. https://doi.org/10.1016/j.jenvman.2014.07.030

Machen, R. (2018). Towards a critical politics of translation: (Re)Producing hegemonic climate governance. *Environment and Planning E: Nature and Space*, *1*(4), 494–515. https://doi.org/10.1177/2514848618785515

Mathews, A. S. (2008). State Making, Knowledge, and Ignorance: Translation and Concealment in Mexican Forestry Institutions. *American Anthropologist*, *110*(4), 484–494. https://doi.org/10.1111/j.1548-1433.2008.00080.x

Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M., & Scapolo, F. (2022). *Towards a green & digital future: Key requirements for successful twin transitions in the European Union*. Publications Office of the European Union.

Niklas, J., & Dencik, L. (2020). *European Artificial Intelligence policy: Mapping the institutional landscape* (Data Justice Working Paper). Cardiff University. https://datajusticeproject.net/wp-content/uploads/sites/30/2020/07/WP_AI-Policy-in-Europe.pdf

Niklas, J., & Dencik, L. (2024). Data justice in the "twin objective" of market and risk: How discrimination is formulated in EU's AI policy. *Policy & Internet*, *16*(3), 509–522. https://doi.org/10.1002/poi3.392

Nost, E., & Goldstein, J. E. (2022). A political ecology of data. *Environment and Planning E: Nature and Space*, *5*(1), 3–17. https://doi.org/10.1177/25148486211043503

Persson, T. (2007). Democratizing European Chemicals Policy: Do Consultations Favour Civil Society Participation? *Journal of Civil Society*, *3*(3), 223–238. https://doi.org/10.1080/17448680701775648

Popartan, L. A., Cortés, À., Garrido-Baserba, M., Verdaguer, M., Poch, M., & Gibert, K. (2022). The Digital Revolution in the Urban Water Cycle and Its Ethical–Political Implications: A Critical Perspective. *Applied Sciences*, *12*(5), 2511. https://doi.org/10.3390/app12052511

Rantala, S., Swallow, B., Paloniemi, R., & Raitanen, E. (2020). Governance of forests and governance of forest information: Interlinkages in the age of open and digital data. *Forest Policy and Economics*, *113*, 102123. https://doi.org/10.1016/j.forpol.2020.102123

Rasmussen, A., & Toshkov, D. (2013). The effect of stakeholder involvement on legislative duration: Consultation of external actors and legislative duration in the European Union. *European Union Politics*, *14*(3), 366–387. https://doi.org/10.1177/1465116513489777

Redden, J. (2018). Democratic governance in an age of datafication: Lessons from mapping government discourses and practices. *Big Data & Society*, *5*(2), 205395171880914. https://doi.org/10.1177/2053951718809145

Redden, J., Dencik, L., & Warne, H. (2020). Datafied child welfare services: Unpacking politics, economics and power. *Policy Studies*, *41*(5), 507–526. https://doi.org/10.1080/01442872.2020.1724928

Ruppert, E., Isin, E., & Bigo, D. (2017). Data politics. *Big Data & Society*, *4*(2), 205395171771774. https://doi.org/10.1177/2053951717717749

Sanchez, L. M., & Nocentini Gori, M. (2024). European strategic autonomy for the twin transition: Ambiguities and contradictions from a spatial perspective. In C. Certomà, F. Iapaolo, & F. Martellozzo (Eds.), *Digital Technologies for Sustainable Futures: Promises and Pitfalls* (1st ed.). Routledge. https://doi.org/10.4324/9781003441311

Sergent, A., Arts, B., & Edwards, P. (2018). Governance arrangements in the European forest sector: Shifts towards 'new governance' or maintenance of state authority? *Land Use Policy*, *79*, 968–976. https://doi.org/10.1016/j.landusepol.2016.08.036

Sikora, A. (2021). European Green Deal – legal and financial challenges of the climate change. *ERA Forum*, *21*(4), 681–697. https://doi.org/10.1007/s12027-020-00637-3

Sotirov, M., & Arts, B. (2018). Integrated Forest Governance in Europe: An introduction to the special issue on forest policy integration and integrated forest management. *Land Use Policy*, *79*, 960–967. https://doi.org/10.1016/j.landusepol.2018.03.042

Urzedo, D., Westerlaken, M., & Gabrys, J. (2022). Digitalizing forest landscape restoration: A social and political analysis of emerging technological practices. *Environmental Politics*, 1–26. https://doi.org/10.1080/09644016.2022.2091417

Vela Almeida, D., Kolinjivadi, V., Ferrando, T., Roy, B., Herrera, H., Vecchione Gonçalves, M., & Van Hecken, G. (2023). The "Greening" of Empire: The European Green Deal as the EU first agenda. *Political Geography*, *105*, 102925. https://doi.org/10.1016/j.polgeo.2023.102925

Viljoen, S. (2020). Democratic Data: A Relational Theory For Data Governance. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3727562

Weinberg, L. (2017). Rethinking Privacy: A Feminist Approach to Privacy Rights after Snowden. *Westminster Papers in Culture and Communication*, *12*(3), 5–20. https://doi.org/10.16997/wpcc.258

Westerlaken, M. (2024). Digital twins and the digital logics of biodiversity. *Social Studies of Science*, 03063127241236809. https://doi.org/10.1177/03063127241236809