Project acronym:	RAINFOREST
Title:	Co-produced transformative knowledge to accelerate change for biodiversity
Grant agreement number:	101081744

DELIVERABLE 3.5

Policy Brief: Enabling transformative change for biodiversity conservation

Lead party for deliverable:	UBO
Document type:	Report
Due date of deliverable:	30-01-2026
Actual submission date:	30-01-2026
Version:	1.0
Dissemination level:	Public
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Food and biomass production systems are among the most prominent drivers of biodiversity loss worldwide. Halting and reversing the loss of biodiversity therefore requires transformative change of food and biomass systems, addressing the nexus of agricultural production, processing and transport, retailing, consumer preferences and diets, as well as investment, climate action and ecosystem conservation and restoration. The RAINFOREST project will contribute to enabling, upscaling and accelerating transformative change to reduce biodiversity impacts of major food and biomass value chains. Together with stakeholders, we will co-develop and evaluate just and viable transformative change pathways and interventions. We will identify stakeholder preferences for a range of policy and technology-based solutions, as well as governance enablers, for more sustainable food and biomass value chains. We will then evaluate these pathways and solutions using a novel combination of integrated assessment modeling, input-output modeling and life cycle assessment, based on case studies in various stages of the nexus, at different spatial scales and organizational levels. This coproduction approach enables the identification and evaluation of just and viable transformative change leverage points, levers and their impacts for conserving biodiversity (SDGs 12, 14-15) that minimize trade-offs with targets related to climate (SDG13) and socioeconomic developments (SDGs 1-3). We will elucidate leverage points, impacts, and obstacles for transformative change and provide concrete and actionable recommendations for transformative change for consumers, producers, investors, and policymakers.

POLICY BRIEF: ENABLING TRANSFORMATIVE CHANGE FOR BIODIVERSITY CONSERVATION

This policy brief synthesises empirical evidence from Work Package 3 (WP3) of the RAINFOREST project to inform policymakers, public authorities, and other decision-makers involved in biodiversity-relevant governance across food and biomass systems. Drawing on five international case studies spanning consumer behaviour, tourism, global commodity chains, and international regulation, it highlights common challenges, enabling conditions, and policy-relevant insights for designing effective, socially acceptable, and implementable policies that can support transformative change for biodiversity conservation.

Key policy messages

1. EU institutions and national governments should strengthen multi-level governance, ensuring that EU frameworks are coherently translated into national strategies and implemented through local and sectoral collaboration.

2. Policymakers at EU, national, and local levels should systematically incorporate behavioural insights into policy design, recognising that consumer decisions are shaped more by price, availability, and default options than by information alone, especially in settings where biodiversity impacts are not salient.

3. National governments and public authorities should consider fiscal incentives, such as taxes on high-footprint foods or subsidies for plant-forward options, which can be effective tools for shifting consumption patterns, especially in settings where behavioural intentions alone are insufficient. However, such measures must be designed with accompanying compensatory mechanisms to protect low-income households and maintain social fairness.

4. Policymakers, in collaboration with private-sector actors, should ensure that technological innovations and market mechanisms (e.g. traceability

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systems, digital monitoring tools) are embedded in appropriate governance frameworks and environmental safeguards, rather than being treated as stand-alone solutions.

5. Public authorities and funding bodies should invest in enabling technologies while also supporting actors with limited resources through financial assistance, training, and capacity-building, so that technological solutions become equitable and effective.

6. Public authorities, businesses, and civil society actors should promote within- and cross-sector collaborations so that producers, businesses, local authorities, and eventually also consumer representatives co-create solutions and share responsibility for biodiversity outcomes.

1. Introduction

Biodiversity loss is driven by uncoordinated decisions across multiple sectors. Agriculture is the largest single contributor to biodiversity loss, mainly through habitat conversion and air as well as water pollution. For example, the expansion of crop and livestock production, especially in biodiverse regions, causes deforestation and intensified agricultural production systems compromise the provision of ecosystem services (Dudley & Alexander, 2017). Fisheries contribute to marine biodiversity loss via direct exploitation and habitat alteration, including overfishing and destructive practices impacting marine biodiversity (Jaureguiberry et al. 2022). International trade externalizes biodiversity impacts, with developed countries importing goods produced in biodiversity-rich developing regions, causing habitat loss and species decline abroad (Green et al., 2019; Lenzen et al., 2012). Tourism increases biodiversity risks through habitat disturbance, infrastructure development, and resource use, especially in sensitive or island ecosystems (Chen et al. 2025; Steibl, Franke & Laforsch, 2021). Consumption patterns, especially of food and biomass, are a major underlying cause of biodiversity loss, with higher per capita income linked to greater biodiversity footprints (Marques et al., 2019; Kok et al., 2018). Food consumption alone accounts for about 40% of global biodiversity loss and unsustainable consumption in the world's wealthiest countries drives losses in many

food and biomass exporting low and middle-income countries (Wilting, 2017).

This policy brief is based on five case studies (Figure 1), each examining a different pathway through which human activities exert pressure on biodiversity using, a mix of empirical surveys, stakeholder analysis, and quantitative footprint and scenario modelling approaches. The **EU Deforestation Policy Case (EUDR Case)** analyses the feasibility and effectiveness of policy–technology mixes to address deforestation embedded in EU imports, focusing on stakeholder preferences, coalition formation, and technological tools to enable biodiversity policies. The **Peru Fishmeal Case** investigates biodiversity impacts and alternative transformation pathways in the anchoveta-based fishmeal and fish oil (FMFO) sector, highlighting regulatory barriers and opportunities for value-chain diversification. The **Plant-Forward Diet Transition Case** quantifies the biodiversity footprint implications of shifting from animal-based to plant-based diets in the UK, Netherlands, and the United States, contrasting substantial theoretical potential with limited consumer intentions to change diets. The **Nordic Consumer Behaviour Case** examines how biodiversity considerations influence everyday food purchasing and meat reduction decisions, showing that social norms and climate concerns outweigh biodiversity awareness (e.g., via biodiversity labels on food products) through in shaping behaviour. Finally, the **Cyprus Tourism Case** explores how food provisioning in a highly seasonal tourism economy affects biodiversity through local production and global supply chains, highlighting the role of procurement practices, menu design, and multi-level governance in enabling biodiversity-positive outcomes.

Figure 1: Case study overview with geographical focus.
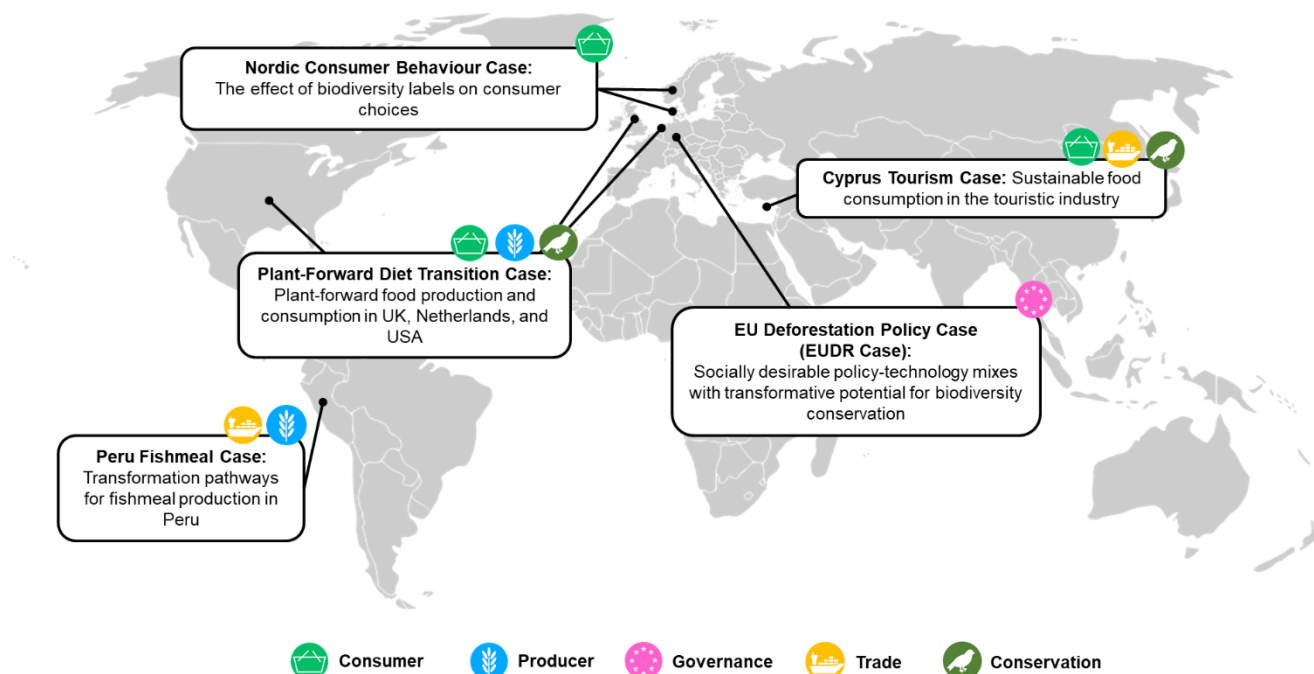
These case studies do not converge on a single policy recommendation, they rather illustrate the diverse nature of biodiversity challenges that can only be addressed by coherent multilateral and multi-level governance arrangements. Biodiversity impacts are frequently externalised across borders, but current policies are often fragmented or insufficiently coordinated. Emerging technological solutions enable better monitoring but do not automatically produce desirable change, including because shifts consumption and production patterns require more than information. Together, these insights provide a foundation for identifying policy directions that are both evidence-based and applicable across contexts.

2. Common Policy Challenges and Enabling Conditions

Across case studies, biodiversity pressures emerge within complex value chains where production and consumption are separated geographically, institutionally, and socially. This separation creates systems in which responsibility for biodiversity loss is shared among many actors, yet accountability remains diffuse. Whether these pressures arise from deforestation linked to EU imports, the anchoveta-based fishmeal industry in Peru, meat-intensive diets in Europe, or the food demands of Cyprus's tourism sector, they share structural features that complicate governance:

diverging stakeholder interests, uncertainties around implementation costs, behavioural resistance, and limitations in monitoring biodiversity outcomes.

Technologies such as remote sensing, supply-chain traceability systems, life-cycle assessment models, and digital tools can help address some of these obstacles by increasing transparency and enabling more adaptive governance approaches. Yet the case studies also show that technological solutions introduce new inequalities when their costs fall disproportionately on actors with fewer resources, and when they serve primarily to ensure compliance rather than stimulate innovation. This tension between technological potential and practical feasibility underscores the importance of designing policies that balance ambition with implementability and fairness.

A further shared challenge lies in the behavioural dimension of biodiversity-relevant decisions. The studies on plant-forward diets and biodiversity-friendly purchasing behaviour demonstrate that consumers often express support for sustainability without translating this into everyday choices. Social norms, affordability, and availability typically play a far greater role than informational tools alone. Similar dynamics were observed in the Cyprus tourism sector, where tourists readily choose more sustainable options when they are made visible, appealing, and convenient, even if biodiversity is not an explicit priority. These insights underline why policy effectiveness depends on shaping the environments in which choices are made, rather than relying exclusively on voluntary behavioural change.

3. Case-specific Policy Insights

The **EUDR case** illustrates how balanced policy mixes must integrate technological feasibility, stakeholder interests, and political acceptability (Braun, Abel & Börner, 2025; Dürr, Dietz & Börner, 2024). Stakeholder preferences for policy instruments diverge (Table 1) and power imbalances among such (lobby) groups can lead to inefficient and ineffective actual policy outcomes. Recent improvements in remote sensing and digital traceability tools were thought to render mandatory due diligence regulations, such as the EUDR, technically feasible, but stakeholder interviews and survey data suggest clear divisions: EUDR opponents are primarily worried about additional administrative and compliance costs, while proponents emphasise the

importance of strong environmental ambition. Despite this ambition, expected environmental impacts may remain limited due to evasion strategies and spillover effects that shift rather than reduce deforestation (Schulz et al., 2026). Deforestation embedded in traded commodities turns out to be a rather poor policy proxy. A more effective approach could combine ambitious objectives with lower implementation costs. For example, taxing forest-risk commodities (Heine, Hayde & Faure, 2021) and reinvesting revenues into targeted anti-deforestation measures, including through finance instruments, such as the recently proposed Tropical Forest Forever Facility (TFFF)[1], could be a more promising approach. This would allow the EU to pursue high environmental ambition while enhancing both effectiveness and fairness in and beyond its supply chains.

Table 1: Stakeholer group preferences for mandatory versus voluntary policy instruments based on literature review.

Stakeholder Group	Mandatory Instruments	Voluntary Instruments
Business	Rejecting position, restricting businesses in their freedom to operate and increases cost of operation. Potentially supporting if economic benefits emerge along environmental goals	Supporting position, businesses are free to comply and decide on their investment
NGOs	Supporting position due to high effectiveness to achieve environmental goals	Rejecting position due to low effectiveness to achieve environmental goals
Citizens	Rejecting position if societal groups are targeted, supporting position if companies are targeted and measures are predominantly considered "fair" in society	Supporting position if societal groups are targeted
Science	Neutral, based on scientific evidence	Neutral, based on scientific evidence

The **Peru Fishmeal Case** shows how the FMFO sector faces structural limitations rooted in its technological lock-in, as well as by limiting regulations and market pressures. As summarised in Figure 2, the sector currently operates within a narrow set of production pathways, each associated with distinct barriers and opportunities for transformation. A key regulatory barrier is that industrial fleets are currently prohibited from landing anchoveta for direct human consumption (DHC), even though

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[1] https://tfff.earth/

their vessels and cold-chain logistics would allow fish to reach ports in better condition than those landed by artisanal fleets. On the market side, the high global demand and stable prices for FMFO incentivise companies to prioritise reduction over more diversified uses of the resource. Allowing industrial fleets to supply anchoveta for DHC could enhance food security by making a high-quality, nutrient-rich and locally available protein source more accessible within Peru, while also opening avenues for new product development. At the same time, innovations such as hydrolyzed protein production, which are already of interest to companies seeking higher-value aquafeed ingredients, demonstrate the sector's technical capacity to diversify beyond traditional fishmeal. However, any expansion of aquaculture that relies on these products, either domestic or international, requires careful governance to minimise risks such as eutrophication, land use change, among other environmental impacts. This case illustrates how technological and market opportunities can only contribute to sustainability when matched with appropriate governance improvements and environmental safeguards.
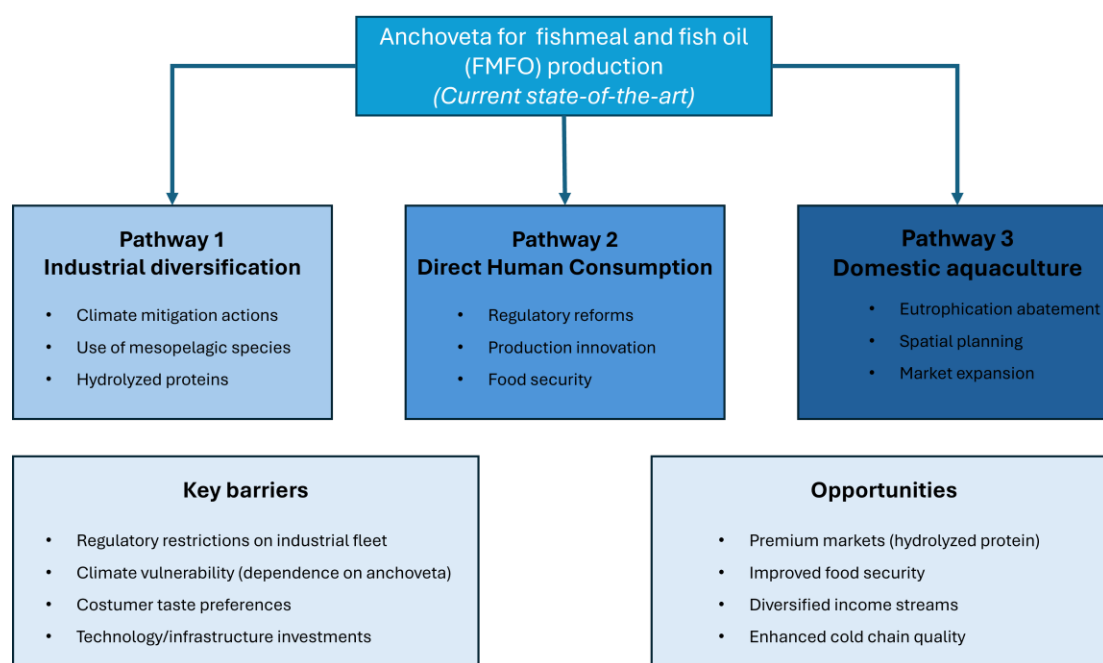

Figure 2: Transformative pathways for Peru's anchoveta-based fishmeal and fish oil (FMFO) industry. The diagram illustrates three potential transformation scenarios for Peru's anchoveta industry, including key barriers and opportunities. Feedback from stakeholder workshops was used in the preparation of this material.

The modelling of meal scenarios in the **Plant-Forward Diet Transition** reveals that dietary change could significantly reduce biodiversity footprints as illustrated in Figure 3. Panel (a) shows participants' intended near-term changes in consumption across three countries. Panel (b) translates these intended changes into projected biodiversity outcomes: in all three countries, even modest shifts toward plant-based alternatives lead to reductions in mean species abundance (MSA) loss, shown by the downward bars and the net-change markers. However, the figure also makes clear that the majority of respondents intend to maintain their current levels of meat and dairy consumption, limiting the overall potential for dietary transitions to achieve substantial biodiversity gains. This gap between the potential demonstrated by the modelling and the limited behavioural intentions underscores the need for supportive policy environments, such as public procurement standards, fiscal incentives, and community-based initiatives, to make plant-forward choices more accessible, affordable, and socially acceptable. When designing fiscal instruments such as taxes on high-footprint foods or subsidies for plant-based alternatives, it is essential to include compensatory measures that prevent disproportionate burdens on low-income households. This case study indicates that the biodiversity benefits of plant-forward diets will only be realised at scale if structural and economic incentives make sustainable options the easier default choice.
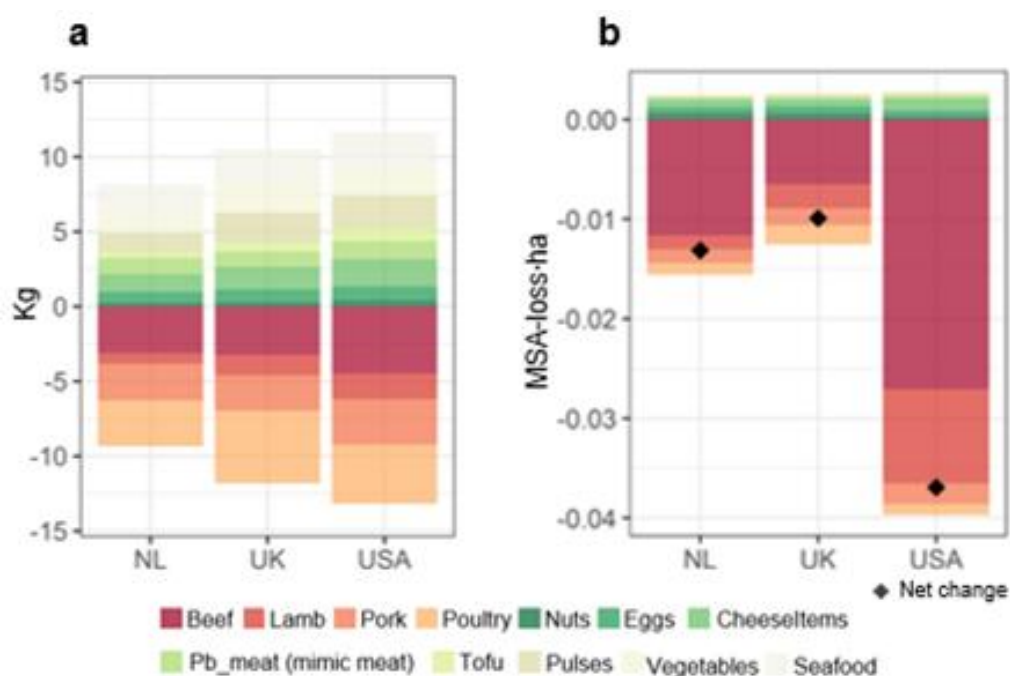
Figure 3: Intended near future consumption of meat and plant-based alternatives (a), and the corresponding biodiversity footprints (b). The figure illustrates that shifts towards plant-based alternatives could reduce biodiversity footprints, highlighting the potential of dietary change to mitigate biodiversity loss.

The **Nordic Consumer Behaviour Case** conducted in Norway and Denmark further substantiates this by demonstrating that biodiversity considerations are not yet deeply embedded in everyday food decisions. Compared to biodiversity considerations, climate concerns are a stronger driver of sustainable purchasing and meat reduction (Figure 4). Attitudes and social norms, rather than knowledge, are the strongest behavioural drivers, while structural barriers such as cost, labelling, and availability continue to prevent good intentions from translating into action. To accelerate change, policy and market interventions must make biodiversity visible and socially supported, engaging early adopters to create new social norms around biodiversity-friendly eating. Given that price is still a very influential factor in consumers' purchasing decisions, it is important that products reflecting biodiversity considerations remain affordable.

Drivers of sustainable food choice
Variance of behavior explained by environmental concern

Purchasing organic food — Biodiversity 24%, Climate 26%
Reducing meat consumption — Biodiversity 30%, Climate 37%
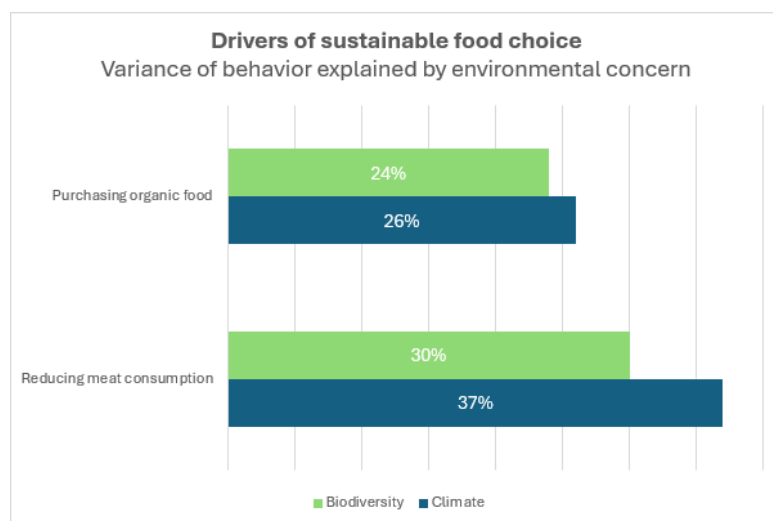
Legend: Biodiversity, Climate

Figure 4: Relative influence of environmental motives on sustainable food behaviours. Climate change concern accounts for more variance in organic food purchasing and meat reduction than biodiversity motives.

The **Cyprus Tourism Case** highlights a seasonal and highly international tourism sector with significant potential for biodiversity-positive transformation. Studies from Mediterranean destinations show that sustainability certifications such as Travelife or GSTC can reduce energy use, water consumption, and food waste in hotels, although measurable biodiversity benefits depend strongly on procurement practices and menu choices rather than certification alone (e.g. Velaoras et al., 2025; Papallou, Katafygiotou & Dimopoulos, 2024; Alipour, Safaeimanesh & Soosan, 2019). Tourists responded positively to local and eco-labelled food when these options were prominently offered, in line with broader evidence that origin transparency and credible labels can shift demand toward lower-footprint products.

A key insight from this case is that existing national and EU tourism strategies tend to overlook food systems by focusing primarily on energy efficiency, transport emissions, and waste management, while paying limited attention to biodiversity impacts associated with food procurement, imports, and menu design. This creates a governance gap between high-level sustainability objectives and the business and consumption decisions that shape food supply in hotels and restaurants.

As summarised in Table 2, a multi-level governance approach can help address these blind spots. At EU level, integrating food system sustainability into the Transition Pathway for Tourism provides an overarching framework. At national level, tourism and agricultural ministries can embed biodiversity objectives into the National Tourism Strategy and support local, seasonal, and plant-based sourcing. At destination level, multi-stakeholder platforms, bringing together farmers, fishers, hotels, NGOs, and local authorities, facilitate coordinated procurement, joint menu planning, and knowledge exchange. Finally, at business level, tourism enterprises can use sustainable procurement practices, increase food-origin transparency, and engage guests in responsible consumption and food-waste reduction. Together, these governance arrangements illustrate how destination-level collaboration can compensate for gaps in higher-level strategies and translate biodiversity objectives into concrete actions across the touristic food chain.

Table 2: Multi-level approach to transitioning governance in the touristic food chain.

Governance Level	Key Actors	Main Actions / Measures
EU Level	European Commission	• Integrate food system sustainability and biodiversity impacts into tourism governance (Transition Pathway)
National Level	Deputy Ministry of Tourism, Ministry of Agriculture, Rural Development and Environment	• Embed food system sustainability in the National Tourism Strategy • Prioritise local, seasonal, and plant-based sourcing • Support agritourism and gastronomy initiatives
Sub-National / Destination Level	Destination Management Organizations (DMOs)	• Create multi-stakeholder governance platforms (farmers, fishers, NGOs, hoteliers) • Foster knowledge exchange, resource pooling and joint procurement of sustainable products
Business Level	Tourism enterprises (hotels, restaurants)	• Adopt sustainable procurement and menu planning • Increase food origin transparency • Engage tourists in food waste reduction and participation in responsible food consumption

5. Conclusion

Achieving biodiversity-positive transformation requires governance approaches that reflect the diverse links between food and biomass production and consumption across sectors. When producers and consumers are in direct contact, as in the Cypriot tourism food chain, local coordination can emerge more readily because preferences, impacts, and responsibilities are visible to all actors. Here, multi-stakeholder platforms and destination-level governance can align consumer expectations with biodiversity-friendly sourcing, resulting in tangible improvements in procurement and menu design.

In mixed production–consumption relationships, such as dietary choices and biodiversity-friendly purchasing, behaviour does not shift through information alone. Because consumers influence biodiversity both locally and through imported food commodities, effective intervention requires public policy that reshapes incentives, through fiscal tools, procurement rules, and supportive social environments, to make plant-forward and biodiversity-friendly choices easier, more affordable, and more socially rewarding.

In highly indirect, international value chains, such as those governed by the EUDR, domestic demand-side measures must be complemented by coherent alignment with

producer-country policies. These settings require shared responsibility for global environmental externalities, including targeted financial support and coordinated monitoring capacities that enable producer countries to meet sustainability standards without disproportionate burdens. The Peru case, situated between these mixed and indirect relationships, illustrates how market and governance reforms could shorten the distance between consumers and producers. By enabling DHC of anchoveta and diversifying value chains, Peru could strengthen domestic food security while reducing environmental pressures from an industry currently shaped by international demand for FMFO.

Taken together, the case studies underline that biodiversity loss is shaped by decisions made across multiple sectors, scales, and actor groups, often along value chains that disconnect consumers from ecological impacts. Effective governance therefore requires policy mixes that combine demand-side incentives, supply-chain regulation, and enabling institutional frameworks, rather than relying on single instruments or one-size-fits-all solutions. Across contexts, successful interventions depend on aligning environmental ambition with social acceptability, economic feasibility, and administrative capacity, while ensuring that responsibilities and costs are shared fairly among actors. Policymakers who integrate these considerations into coordinated, multi-level strategies can strengthen the effectiveness and legitimacy of biodiversity policy and support durable pathways toward biodiversity conservation in Europe and beyond.

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