

Policy brief

Need for seeds: securing a safe supply chain for successful nature restoration

It is estimated that **1.9 billion tons of native seeds** will be globally needed to meet the restoration targets (350 million hectares) of the UN Decade on Ecosystem Restoration. Such a large quantity cannot be sourced from the natural ecosystems that are already greatly reduced and fragmented. As native seeds are difficult to produce and the supply is limited, there is a **risk of using uncertified material** of unknown origin which could **compromise nature restoration efforts**. It is highly recommended to only **use native or locally adapted seed mixtures that include a label of origin, and detailed description of the species composition and quantities, and to prioritise species and seed lots from local origin** whenever possible.

To support this cause, this brief outlines key recommendations for national policymakers to support **a safe seed chain supply** for nature restoration within the framework of the Nature Restoration Regulation (NRR¹).

Key Policy Recommendations

- Introduce principle of avoidance of maladapted plant material for restoration operation into National Restoration Plans (NRPs);
- Use Seed Transfer Zones as a proxy solution to identify locally adapted plant materials;
- Establish a roadmap to secure seed supply for nature restoration operation;
- Get inspiration on good practices, tools and standards from case studies (USA, Germany, France).

1. Footnotes can be found in the information sheet.



Key observations

The origin of plant material is a crucial societal and ecological issue

In many contexts, effective restoration requires the active introduction of plant material (sowing, planting, hay transfer). Because **plants form the structural foundation of ecosystems, poor choices at the early stages can lead to long-lasting negative effects.**

Passive vs. active restoration: when seeds become indispensable

Interventions can range on a gradient from passive restoration (assisted natural regeneration) to active restoration, involving the voluntary introduction of seeds or plants. In many European landscapes, habitat fragmentation, the depletion of soil seed banks, and the lack of ecological connectivity, mean that natural regeneration alone is often insufficient. In these cases, the introduction of propagules (seeds, plants, hay transfer) becomes essential. **This makes the choice of seeds a critical policy decision, and not a minor technical detail.**

Key risks of poor seed sourcing

- **Poor ecological adaptation:** low germination and survival, failure of establishment, unstable plant communities, lack of ecosystem functionality, risks of apparition of exotic diseases and pests while using non-native seeds.
- **Genetic pollution:** alteration of local populations and genetic heritage, loss of local adaptations acquired over the long term, homogenisation of landscapes.
- **Biological invasion:** introduction of non-native species or sub-species that become dominant, threatening local biodiversity.



- **Lack of climate resilience** in the face of droughts, extremes and future changes.
- **Loss of effectiveness of public investments:** restoration failure resulting in increased corrective management costs.
- **Loss of credibility in restoration policies:** consequences of risks mentioned above may alter the trust in nature restoration operations.

These risks are scientifically documented and observed in practice. They are also incompatible with the essence and performance obligations of the NRR.

Multiple constraints: local vs. availability vs. future climate

National policymakers implementing the NRR face a triple constraint:

- 1. Usage of local materials:** to ensure ecological adaptation and preservation of genetic diversity.
- 2. Meeting massive and rapid needs:** the volumes required to achieve the 2030 targets far exceed the current supply of native seeds.
- 3. Anticipating climate change:** strictly local populations may become unsuitable in the medium term.

Locally adapted material is adapted to current conditions but these are changing quickly. This is why “prestation” (utilising species in restoration for which a site represents suitable habitat now and into the future)² or active restoration combined with assisted migration is crucial.

There is no single solution; sourcing strategies must be **tailored to each context** (e.g., strictly local, extended local, composite or predictive sourcing).

Seed Transfer Zones: a key tool for action

Rules of provenance have long been established for forest tree species in Europe. For herbaceous species found in meadows, wetlands and grasslands, or even forests, the diversity can be much greater but rules of provenance are rarely present or applied, due to the lack of genetic information.

A recommended proxy/broad solution

- Use Seed Transfer Zones (STZs):
 - based on biogeographical and climatic regions,
 - allowing for transfers with a low risk of maladaptation,
 - more realistic than species-by-species approach,
 - compatible with rapid implementation of the NRR,
 - compatible with cross-border cooperation (e.g., Alps, river basins, common biogeographical regions).

These zones constitute a pragmatic compromise that is scientifically based, and applicable on a European scale. In case of rare or endemic plants, STZs can only be used with caution.

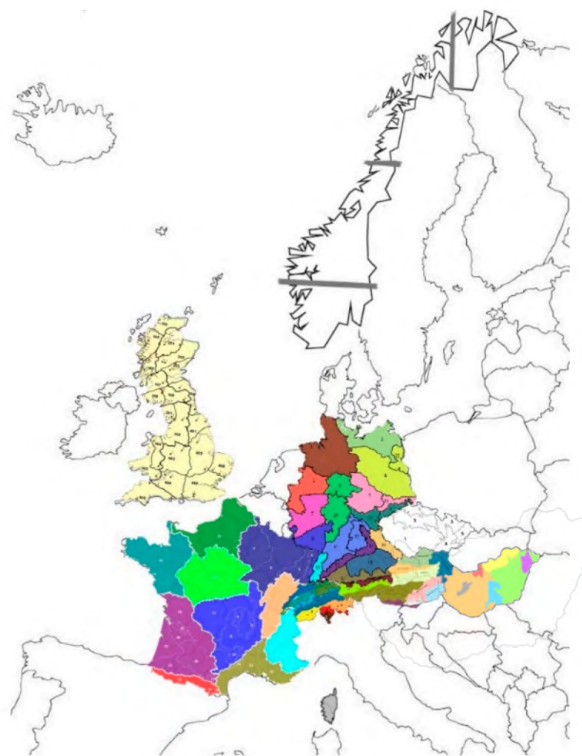


Fig. 1: Seeds should be collected or propagated within the same zone where the restoration is planned (De Vitis et al., 2017 & Cevallos et al., 2020).

A critical feature: the native seed sector in Europe

The availability of native seeds is currently the main bottleneck in the nature restoration industry. While some countries – such as France, Germany, Belgium, Austria - have structured supply chains, these remain poorly traceable and face a wide variability in material quality. **Thus 90% of the market is still dominated by uncertified seeds.**

Developing structured and traceable native seed supply chains would allow to:

- secure the implementation of the NRR,
- create skilled local jobs,
- reduce dependence on unregulated markets,
- improve European autonomy and the efficiency of public spending.



Diverse seed mix. Photo: Miglécz Tamás

Policy recommendations

NRR expectations from national policymakers

In the frame of the NRR implementation, it is essential that EU and national policymakers establish a roadmap, readily applicable by the competent authorities, in order to:

1. Anticipate future needs

- **Estimate seed requirements several years in advance**, to prevent last-minute compromises on seed quality and origin.
- Integrate the issue of seed availability from the design stage of National Restoration Plans (NRPs).

2. Structure the supply chain

- Countries should support the collection, multiplication and storage of native seeds. Where possible, use botanic gardens and seed banks as seed hubs.
- Encourage certified and traceable supply chains and support seed producers that are already in the area of native seeds with traceability.

3. Frame seed supply

- NRPs should include clear and verified indication of the origin of the seeds.
- Avoid using unsuitable generic mixtures, which risk introducing non-native and invasive species.
- Publish and distribute guidelines and code of conducts for collection, storage, production and reintroduction of native seed material.

4. Coordinate across borders and sectors

- Promote coherent cross-border approaches especially in shared biogeographical regions.
- Promote collaboration between scientists, botanical gardens, producers, project managers and public authorities to harmonise standards and share best practices.

5. Support the native seed sector growth

- Targeted supports are needed to scale up native seed production to foster:
 - collection,
 - training,
 - propagation of native seeds,
 - cleaning and storage infrastructure.
- **Forward contracts** can stabilise the market and secure producers and users.
- Create **seed banks dedicated to restoration** as conservation banks or botanical gardens can only offer limited amounts of seeds.

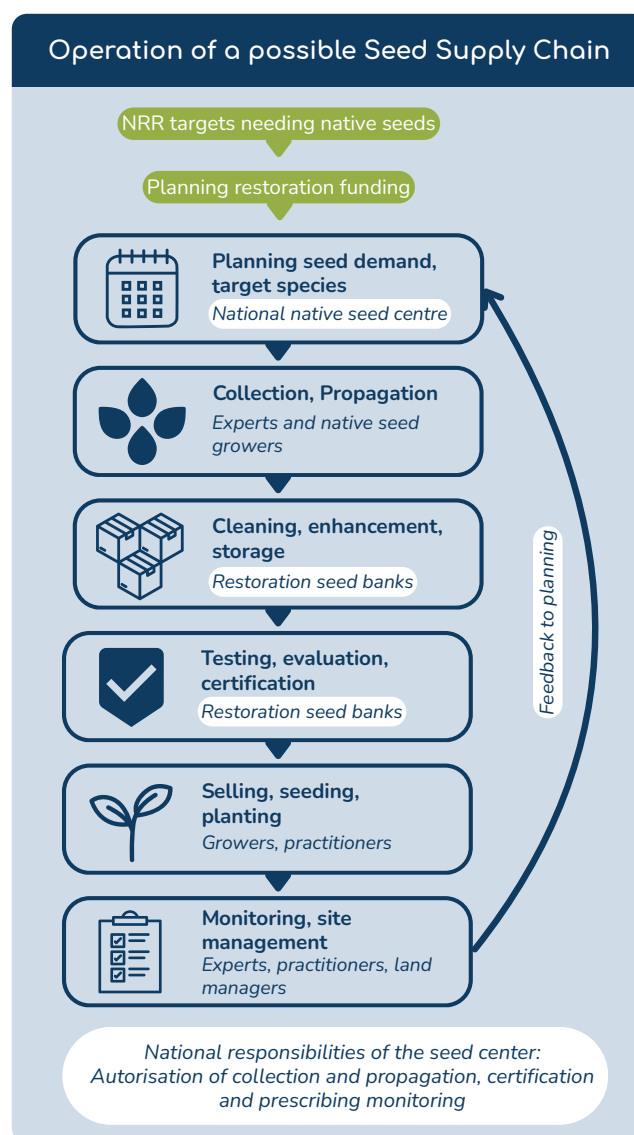


Fig.2: Suggested elements of a seed supply chain and actors (Pedrini and Dixon 2020 complemented).

Global lessons of good practices

The National Seed Strategy of the USA, developed to address the shortage of native seeds has been under implementation for 10 years, and has made significant progress in increasing capacity, among others, by accomplishing nearly 500 production fields and 25 [Plant Material Centres](#).

A good summary of how a native seed supply chain may operate is the film produced by the [International Network for Seed Based Restoration](#). The [Seedlot Selection Tool](#) and the [Seed4Forest](#) tool may also help planning seeding.

The [Restore & Renew webtool](#) goes further, it provides collection area estimates for 100 species for the south-eastern part of Australia, including for present and future climates.

In Europe, Germany and France have developed their native plant translocation and propagation certifications for a decade now, however, the market is still dominated for 90% by non-certified seeds. This underscores a need for Europe-wide harmonisation of native seed standards. The [ENSPA Code of conduct](#) could serve as a model for such a standard.



Conclusion: restore quickly, but restore safe

Nature restoration is not about “growing anything, anywhere”, but about rebuilding functional, resilient and sustainable ecosystems – and that starts with the right seeds.

For EU and national policymakers, avoiding risky restoration means:

- **Introducing** elements to support **the use of adapted plant materials** into every NRP and for **each ecosystem considered**; see table 1;
- **Establishing a strategy** in parallel to the NRP to support the **implementation of a safe seed supply chain** for nature restoration, addressing the steps and using the resources provided in the table “Guidance to build a roadmap for native seed supply from planning to planting” (Table 2³).



Seeds of *Dianthus serotinus*

Table 1: Recommended Policy Actions to address risks linked to specific NRR articles

NRR article	Management mistakes regarding the origin of plant material	Consequences for implementation	Recommended political actions
Article 4 Terrestrial, coastal and freshwater habitats	Introduction of plants not adapted to the reference plant communities, failure of restoration efforts.	Failure to achieve a favourable state of conservation, unstable restorations.	Define and utilise Seed Transfer Zones (STZs), require proof of provenance in NRPs.
Article 8 Agricultural Ecosystems	Use of general or non-local mixtures.	Floral homogenisation, minimal gain in biodiversity.	Limit the use of generalist species, promote native seeds adapted to targeted agricultural habitats.
Article 9 Forest Ecosystems	Neglect of herbaceous and shrub layers.	Incomplete ecological resilience, associated loss of biodiversity.	Extend the rules of provenance to all plant strata.
Article 10 Pollinators	Plant-pollinator desynchronisation.	Ineffectiveness of pollinator support measures.	Prioritise key local species for pollinators, integrate functional criteria.
Article 11 Urban Ecosystems	Confusion between ornamental greening and restoration.	Risks of invasive species; negative effects outside urban areas.	Demand traceability, certified origin and ecological suitability.
Articles 15–16 National Plans	Underestimation of native seed needs.	Delays, shortages, use of unsuitable equipment.	Plan needs 3–4 years in advance, support the supply chain.
Articles 17–18 Monitoring and Reporting	Lack of data on origin.	Inability to assess the causes of failure or success.	Include indicators of origin and seed quality.

Link to sources


[BiodivRestore Knowledge Hub](#)


The scientific publications used in this policy brief can be found in the information sheet of this briefing, downloadable from: www.biodiversa.eu/policy-briefs/

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About this Policy brief

This Policy Brief is part of a series aiming to inform policymakers involved in the implementation of the [Nature Restoration Regulation](#) with policy recommendations based on the expertise of the BiodivRestore Knowledge Hub experts.

The series of Biodiversa+ Policy briefs can be found at www.biodiversa.eu/policy-briefs/.

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