Guidelines for knowledge transfer on the conservation of forest genetic resources

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FORGENIUS

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Abbreviations

FGR	Forest Genetic Resources
GCU	Genetic Conservation Unit
EUFORGEN	European Programme on Forest Genetic Resources
EUFGIS	European Information System on Conservation of Forest Genetic Resources

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1. Introduction

The conservation of forest genetic resources (FGR) can be carried out *in situ* in the form of Genetic Conservation Units[1] (GCUs). The minimum requirements for establishing GCUs have been defined by the European Genetic Resources Programme (EUFORGEN) and are available at https://eufgis.org/about/genetic-conservation-units. GCUs form a network designed to cover various pedo-climatic conditions and habitats within their species' distribution range. They contribute to maintain population genetic diversity through the combined effects of natural environmental pressures and ongoing sexual reproduction.

Within this framework, it is important that various stakeholders are informed about the established GCUs, their characteristics and the potential challenges they may face. Stakeholder engagement can assist forest management, support coordinated actions across regions and ensure long-term commitment towards the conservation of FGR. Stakeholders include forest managers, researchers, policymakers, the coordinators of genetic conservation programmes and other biodiversity conservation networks, as well as the general public. A range of communication tools and media are available to facilitate knowledge transfer, each offering complementary options that can be selected according to the local context.

[1] https://www.euforgen.org/forest-genetic-resources/conservation/gcu

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2. Identification of genetic conservation units in a forest area

For forest managers, researchers, policymakers and the general public to be aware of an established GCU, it must be easily identifiable.

Add an explanatory sign for each genetic conservation unit

Advantages: An on-site sign allows all stakeholders, forest managers, researchers or visitors, to identify the precise location of the GCU and understand its purpose. It can include a QR code linking to a website (e.g., EUFGIS or a national information system) with additional information. The cost of producing and installing such a sign is relatively low.

Disadvantages: The sign must be placed in a strategic and visible location. It may also have a limited lifespan and be subject to damage and it may require regular maintenance depending on the materials used. If a QR code is included, reliable connectivity and functioning webpages are required. Even if the cost of each sign is moderate, the total cost for across a large GCU network can become significant. Additionally, not all owners wish their forest to be identified, particularly in case of a private property.

Marking the outline of the conservation unit with paint

Advantages: The GCU can be quickly identified, and the marking is visible to all visitors. The cost of applying paint to boundary trees is moderate and does not require special equipment.

Disadvantages: The marking requires regular maintenance, every 5 to 8 years, as it faints over time. Depending on the tree age and forestry activities, it may even be lost and need reapplication. While this method indicates the GCU outline, it does not provide information about the purpose of the plots.

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3. Documentation on the genetic conservation units

The pan-European EUFGIS Portal

Advantages: The pan-European information system on FGR is publicly available and free at https://eufgis.org/. The information is updated by the EUFGIS National Focal Points of the countries participating. The platform contains not only general information on the GCUs but also local climatic variables (past, present and future) as well as recent and current stand-level functional characteristics derived from remote sensing data (can be used to detect signs or decline). In addition, for some GCUs, more detailed environmental, phenotypic, genetic and forestry indicators are also available. The documentation platform enables harmonized reporting and monitoring of the genetic conservation programmes for both national and international purposes. The platform is also used as a tool for identifying gaps in genetic conservation efforts.

Disadvantages: The EUFGIS platform is only accessible in English. The environmental characterization uses European databases and tools (climate and remote-sensing data), but specific national environmental zoning systems are not incorporated. The data must be locally verified and specified.

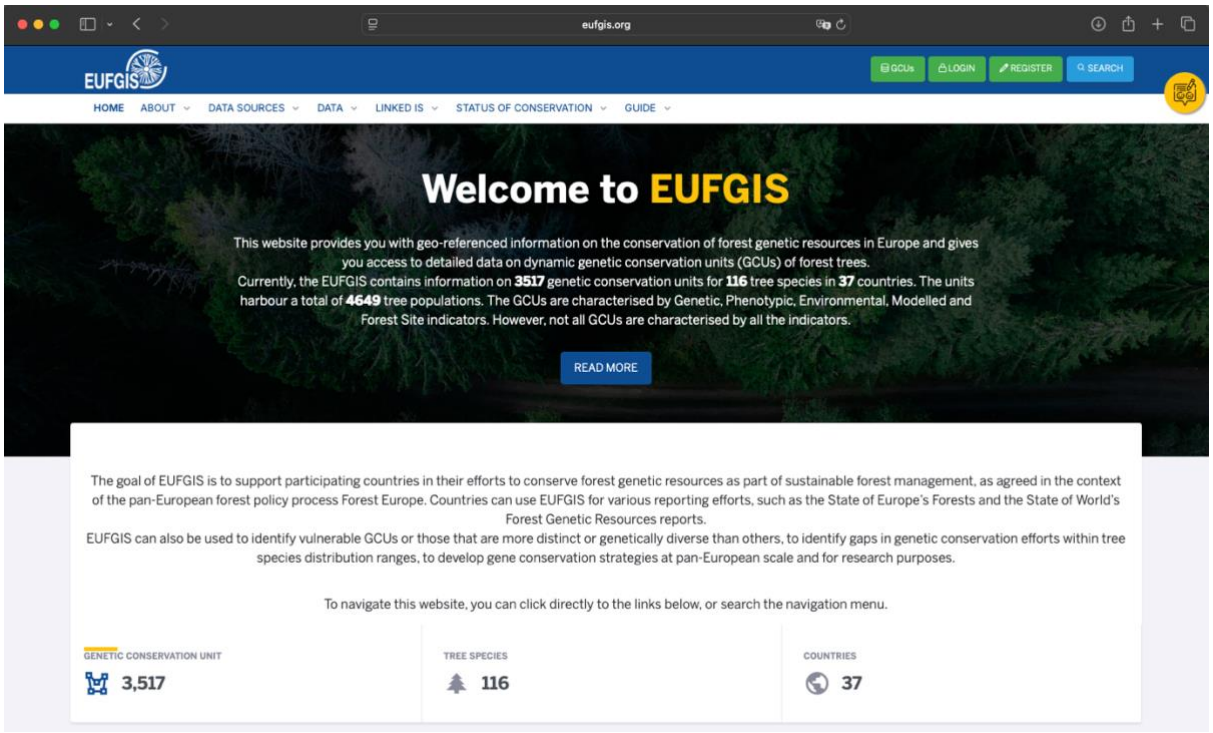

Figure 1. The EUFGIS portal interface (eufgis.org)

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National registers

Advantages: Managers of GCUs generally have easy access to national registers. In addition to the location of each genetic conservation unit, complementary information can also be added, such as forestry type or management status. The registration of GCUs in official documents ensures their formal recognition at the national level and supports their referencing and long-term monitoring. National registers are available in the local language and when a country uses a specific environmental zoning system, this is usually reflected in the national registers.

Disadvantages: Most national register documents are only accessible to GCU managers. Information must be updated whenever management plans or related documents are revised. Depending on the structure of the national documentation, relevant information may be found in different sections, making the interpretation less forward. Once a GCU is recorded in official documents, modifying elements such as boundaries and objectives becomes more difficult due to administrative procedures and legal constraints.

Associated data in other databases or internal websites

Advantages: Databases related to soil, habitats and climate are easy to identify and access and offer a wide variety of information. Each GCU can benefit from these datasets, which can provide insights that can be directly used by managers and policymakers. Such data help characterise the soil and climatic conditions of the GCU based on regional or county-wide data.

Disadvantages: The data may be scattered across different sources: databases, naturalist repositories, development projects, scientific publications, etc. Their quality can vary and many datasets may reflect only the conditions at the time of collection, without regular or automatic updates. Data collection is not always systematic and information obtained by satellites, LIDAR or drones may require processing by specialists. Also, some of these methods are still at an experimental stage for certain variables (e.g., height, mortality, etc.).

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4. Interactions between the genetic conservation unit manager and the genetic conservation programme coordination structure

This interaction is essential to ensure that the manager of the genetic conservation unit is fully informed of all management obligations and that a continuous flow of information is maintained between the different actors involved in conservation.

Field visits

Advantages: Field visits help to strengthen the relationship between local forest managers of GCUs and coordinators of conservation programs, who can then continue their further collaboration and communication after the visit. They encourage managers to dedicate time to prepare for the meeting and present any problems they are encountering in the management of the genetic conservation unit to the coordinators. Field visits also provide an opportunity to gather information about the broader GCU network within the country and abroad.

Disadvantages: Organising field visits require substantial preparation and travel time. They must be planned in advance and require commitment from both the manager and coordination structure. The associated financial and time costs may limit the number visits per year.

Remote exchanges with local manager: email, telephone, videoconference

Advantages: Meetings can be planned in advance and require less time than field visits. They allow for at least a telephone or video conference exchanges per year to maintain the link between the manager and the coordination structure. Major planning issues can be discussed remotely and may lead to the organisation of a field visit.

Disadvantages: Remote exchanges are effective only if the local manager is familiar with the conservation objectives and the coordinators to deliver appropriate responses to the manager's requests. They do not allow for discussion of the technical management details that require on-site observation.

Remote exchange for a sub-network of connected GCUs: live webinars

Advantages: When a species is conserved through multiple GCUs distributed across a country, live webinars allow all managers to receive the same information simultaneously. During these network meetings, dedicated time can be allocated to discuss specific issues identified by managers. Webinars also create opportunities to invite scientists to present the

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state of the art in the network's species conservation. They represent a low-cost solution and can be organised regularly without travel.

Disadvantages: Specific site-level cases cannot be addressed in detail. Remote meetings do not allow all stakeholders to be trained, and participation may be limited to those who are most motivated. Discussions are more structured and less spontaneous than in-person meetings. Preparing contributions and reporting back on discussions can be time-consuming. Webinars do not offer the same personal connection between the manager and the coordination team due to the lack of in-person interaction. They must be organised at least once per year, and a report must be produced.

In-person meetings

Advantages: A 1.5- to 2-day meeting bringing together all GCU forest managers in the country allows them to discuss the day-to-day management of their GCUs, regardless of the species involved. Such meetings help create and maintain a sense of belonging to a national program, more efficiently than remote meetings. They can be combined with a visit to a genetic conservation unit to, providing an opportunity to exchange views on the practical issues directly in the field. In-person meetings also offer a platform to invite researchers to share knowledge, present ongoing work and formulate new research questions.

Disadvantages: Organising these meetings requires time and financial resources. Stakeholders must coordinate to clarify expectations and organise feedback. If the objective is to share knowledge and encourage input from local managers, advance preparation is necessary. Similarly, the needs and concerns collected from local managers must be followed up with concrete action. This process requires a strong institutional and political commitment to the conservation of forest genetic resources.

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5. Raising awareness of *in situ* genetic conservation actions to various stakeholders

In situ genetic resources conservation networks are, by their very nature, an excellent means of monitoring the evolution of genetic resources across the species' range. GCUs in marginal conditions act as sentinels in the context of climate change. Despite their unique role of these networks in Europe, they often suffer from limited visibility.

Brochure presenting genetic conservation units

Advantages: A brochure provides managers and stakeholders with a simple, accessible document summarising the conservation strategy applied in the country. It can be shared with different communities during meetings or discussions to raise awareness of the network. Using a common template allows information to be disseminated across multiple media outlets, increasing the chances of wider coverage. The materials can be easily downloaded and printed, and they can include references or links to additional resources. Furthermore, brochures can be customised for each genetic conservation unit to highlight specific features.

Disadvantages: A template needs to be created and distributed to the appropriate target audiences. The document requires regular updates to remain accurate and relevant. Individuals or agencies distributing the brochure must be prepared to answer questions that may arise from readers. Communication departments need to be involved and able to respond quickly. Producing articles or reports on the conservation of GCUs also requires coordination and planning.

Newsletters

Advantages: Newsletters allow anyone interested in genetic conservation networks to stay informed about their activities. This help increase the visibility of genetic conservation networks and provide a regular link between the various actors, thus helping to bring the community together. Newsletters can highlight specific networks, individual GCUs or ongoing projects. They can be easily distributed and can include references or links to additional information and media.

Disadvantages: Producing a newsletter requires a dedicated person to collect, compile and format the information. For this to work effectively, each stakeholder must contribute to the content or updates. The publication frequency must be balanced: not so high, that readers lose interest, yet regular enough to ensure a steady flow of information. This communication activity can be time-consuming.

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Popular science articles: articles in professional journals

Advantages: Such articles allow the conservation strategy and the scientific knowledge underlying it to be shared with a broad audience. They can be distributed widely and serve as a reference for genetic conservation unit managers. Preparing these articles requires exchanges between stakeholders, which strengthens collaboration. Publishing in professional journals also lends credibility and visibility to the genetic conservation networks.

Disadvantages: Publications requiring more than a few minutes to read reach only those already interested in genetic resources conservation. They require time to review and update the state of the art. The journal must be carefully chosen to make sure that the article reaches the appropriate readership and is easily accessible. Writing, coordinating, proofreading, and publishing can be time-consuming and costly.

Technical articles

Advantages: Technical articles provide detailed accounts of scientific studies carried out on genetic conservation networks. They help managers and policymakers better understand the importance of these networks and the need to support them. They also help familiarise and train stakeholders in new techniques. These articles provide essential feedback to managers who may have contributed equipment, data or information. They can also be combined with enrichment of databases linked to the network.

Disadvantages: Writing technical articles requires scientists to devote additional time and effort to communicate their findings beyond scientific articles, which are often not easily accessible to managers and policymakers. Preparing such articles also requires collaboration to ensure that the content is adapted to the knowledge level and needs of the various target audiences.

Website and web page for the general public

Advantages: A website offers round-the-clock visibility of *in situ* genetic conservation actions to all audiences, regardless of location. It is the most common entry point for people seeking information and allows content to be centralised in single space, with links to complementary resources. The digital format is dynamic and enables information to be added or updated regularly without redesigning the entire document. It also allows for interaction with interested users. Hosting a dedicated web page on the websites of the different stakeholders increase the visibility of genetic conservation activities. In addition, a private section can be included for network actors, allowing them to store data and internal documents.

Disadvantages: The website must be updated regularly and be well referenced. It requires a clear and coherent visual identity. All external links must remain active and functional. The cost of creating and operating a website can be high and specific technical skills are needed for its development and maintenance. As an online platform, it may also be a target to cyber-attacks.

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Videos and podcasts

Advantages: Short formats, such as videos and podcasts, allow for a wide variety of topics and capture the audience's attention. Videos provide an immersive experience and can have a lasting impact. Partnerships with well-known YouTubers or content creators can help reach larger audiences. These media can be used both to inform and to educate, and they can be uploaded quickly and easily. Depending on the production method, costs may range from very low or very high. They also encourage audience loyalty and engagement over time.

Disadvantages: Their lifespan can be short, requiring frequent renewal. The tone and format are as important as the content itself. Production can be complex and costly in terms of human and financial resources. To ensure success, the target audience must be clearly defined.

Recorded webinars

Advantages: Recorded webinars allow a specific topic to be addressed in a structured manner over a set period. They can target different types of audiences depending on the topic, ranging from *in situ* genetic conservation and the impacts of climate change on genetic diversity to project updates involving multiple stakeholders. They allow to quickly gather information on a topic. Once online, webinars remain available online and can be viewed at any time. They help raise awareness of the genetic conservation networks, their stakeholders and their actions.

Disadvantages: Recorded webinars are not interactive, and they require a significant amount of regular effort and coordination. They may overlap with other communication tools, such as articles. Also, they must be well referenced and searchable to ensure visibility in the long-term.

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