



# DIVERSIFOOD

*Embedding crop diversity and networking for local  
high quality food systems*

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- ☐ **CI:** Classified, as referred to in Commission Decision 2001/844/EC

## Abstract

This deliverable presents the results of the work done in WP4 during the 4-years project, putting in evidence the main points useful for policy recommendations. It also summarises the many documents, meetings and workshops organised by WP4's partners.

DIVERSIFOOD policy recommendations are focussing on the paradigm shift from on farm conservation to community biodiversity management (CBM), emphasizing the collective action of multi actors groups managing locally different kind of varieties/populations. This new paradigm includes not only the classical conservation of landraces or heirloom varieties, but also paves the way to include innovation in the overall system. In fact it considers decentralised and participatory breeding/research as one of activities included under this definition. DIVERSIFOOD also recognised the role that can play new actors as Community Seed Banks. They are important element in between gene banks and users, facilitating access to and seed multiplication. Moreover DIVERSIFOOD recommends that policies and rules are appropriate to maintain evolution and diversity within seed systems, facilitating access to public genebanks and the flow of knowledge among the different actors.

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## The work done

This first part highlights the results achieved in WP4 and the activities done.

### 1) Questionnaire on seed production systems

The questionnaire to evaluate the seed production systems across Europe started in February 2016 and has been answered by the partners of the DIVERSIFOOD consortium and their network-members. **The objective** was to describe plant propagation processes, quality control and monitoring systems related to tomato, wheat, maize, carrot and potato.

**The questionnaire has been structured like this:**

- Characterizing the organisation of farmer who answers the questionnaire (4 Questions)
- General questions related to seed production (11 Q.)
- Monitoring, documentation and training (10 Q.)
- Seed production species-specific questions
  - Receiving seeds (3 Q.)
  - Sowing (2 Q.)
  - Growing phase (8 Q.)
  - Harvesting (5 Q.)
  - Cleaning and drying (11 Q.)
  - Additional questions about using a manual, financial and working month investments

44 Questionnaires have been filled and 28 partners filled in the crop specific answers as well.

#### Some results

Most of the partners had more than 10 years of experience in seed propagation for their specific crop. 45% of the partners had the possibility to use green houses for the propagation of seeds. 19 worked on open fields and 7 in garden plots. Most of them were organic and biodynamic farmers (85%). 41% of the responding partners always send seed or propagation material back to the provider, 33% never and 27% sometimes. 57% of the participants use a **documentation and monitoring** system for their seed production. Of those the databases used are: Access, FileMaker, Mysql, Schinema, PostgreSQL. 5 partners consider Excel as their database. 65% of the participants use **feedback systems**. Most of them do it by hand-out paper (60%) some collect feedback by email and electronically (27%). Others organise field visits and get feedback face to face. Field visits are organised by 80% of the participants. Very often, the documentation, feedback system, monitoring quality depends a lot on the project the organisation is involved in. If the organisation or the farmer-network is part of a bigger project, documentation is much more elaborated than in the daily work process. The number of descriptors used to describe a variety depends on the demands of the ongoing project and can vary from 10 up to 30. If descriptors are mandatory 33% use UPOV or IPGRI descriptors. Still 53% use specified descriptors – sometimes based on UPOV or IPGRI descriptors. In addition to that organoleptic characteristics are documented.

**Data management:** 50% of the partners enter their data in their local database. 19% enter their data into a database that is not managed locally but by an external focal point managed by the organisation. 31% collect their data on paper and collect them in a folder. 60% of the organisations do validate the information coming from the farmers and gardeners. Most of them have a kind of expert group that is supporting them to do so. 40% collect all data coming from their members or partners without validating them systematically.

**Learning and know how transfer:** It looks like the organisations respond quite well to the demands of their members. 86% responded that they offer field visits and organise meetings and workshops. 41% develop specific literature and specific learning tools. Online tools like youtube videos or facebook groups are offered by very few organisations but they are not really on demand. Most of the information is transferred on Word documents (58%) and 41%

on printed documents whereas only 26% give access to databases for knowledge transfer or use newsletters (16%).

The **collaboration** between the partners within the organisation that are involved in the seed production process can be based on contracts or specific rules when the collaboration is connected to a specific project that partners have accepted. During the daily business, collaboration is based mostly on handshake agreements or oral accordance. SMTAs (Standard Material Transfer Agreement) are only used in relation to official EU-projects. When it comes to more informal seed exchanges between farmer or gardener organisations no or very rarely SMTAs are used. 80% of the actors got their seeds from genebanks (50% in the case of potatoes), 90% from farmers and seed savers networks. 50% from private seed companies (70% in the case of potatoes). Most of the used varieties are landraces (80%) followed by obsolete varieties (70%) and commercial varieties (50%) and own selections. Some use even wild varieties. When it comes to cereals populations and mixtures are mentioned many times (40%). All partners were very aware to avoid mix-ups. They use planting schemes and placards on plastic (better than wood) to mark the plants on the field.

**Receiving seeds:** For most of the crops besides passport and characterisation data, very few evaluation data were available when the recipients got their seeds. Seed health is verified by exterior control. Further analyses with laboratory methods are rarely applied. Normally there is no seed treatment. For cereals hot water and steam treatment have been mentioned. For potato wood ash or rock flour has been applied to seed tubers during storage phase.

**Sowing/planting:** For the field preparation, we got a lot of different techniques to improve the soil quality. These techniques have been compiled to a list of best practice examples. For tomato and potato as well as for maize the indicated space between plants and rows differed considerably from one producer to the other due to different soil quality, climate and variety. We had to recognise that it is very difficult to give indicators that fit all the local and regional peculiarities.

**Growing phase:** For every crop we could collect a lot of different suggestions how to maintain the plants, how to react to diseases. Because the crops are grown for propagation purposes, ill plants have been eliminated to select populations or varieties for hardiness. Besides this, treatment methods were mostly applied to support the plant and not as much for plant protection. In the case for watering and fertilizing plants are maintained in a way that they have to prove their hardiness and resilience to drought and suboptimal conditions. The applied measures had to fit the gardeners or farmers production systems and not to what is technical feasible.

As a **selection** method, negative and positive mass selection have been mentioned for tomato, cereal and maize. For carrots and potatoes negative mass selection has been indicated predominantly by gardeners and farmers. The selection criteria like hardiness, yield, shape, plant health, calibration, uniformity and genetic variability have been applied differently from crop to crop and from partner to partner. Surprisingly it was not easy to give a comprehensive picture to state which criteria are the most important and most valuable and which not. Plant health was very important for all crops, taste was important as well. The factor yield was not as important and calibration and uniformity was more important for field crops like maize and potatoes. As DIVERSIFOOD was considered to promote participatory breeding methods, it was interesting to see that some of the participants who answered to the questionnaire were answering yes when we asked if they prefer to do the selection work on the field by themselves and not in a group. But they answered all very positive to the process to define selection criteria together in a group.

**Harvesting, drying and storing** activities were described for all the five crops. For these steps crop specific conditions and facilities are needed. To get the best fruits for seed production repeatedly harvesting has to be done and adequate threshing, drying and storing as well as packaging facilities have to be provided. Not all participants differentiate between long- and short-term storage (besides potato where no long-term storage was discussed). Most of the loss occurs for carrots when the roots are stored. Even if they are stored in a

climate room. For potatoes and carrots during this storing period, an established monitoring system has to be implemented. In the questionnaire, specific diseases are mentioned and best storing conditions are discussed. Most of the packaging is done manually in paper or tissue bags for short-term storage and in vacuum-sealed bags for long-term storages. Storage in glass container is done as well. Some semi-professional – professional seed producers use germination rate testing and measure humidity before they store the seeds. The development level of these processes differs from partner to partner and it would be favourable to find the most appropriate and not the most sophisticated solution for every partner. At the end of the questionnaire the different participants gave interesting information about the time they have to invest for the specific propagation and selection work to produce high quality seeds. All agreed that the work is very time consuming and that they invest a lot of voluntary work. Even if they are able to get a good price for their product. After all the answers differed very much from participant to participant. Most of the participants would like to increase the population size for each regeneration step and to work on better evaluation data. Some wished to have better storage and drying equipment on their farms.

## **2) Databases for CSBs**

Community seed banks (CSBs) collect and record different types of data that can be stored and analysed to support actors in managing crop diversity. Databases are efficient tools to store and manage information in CSBs. A survey was conducted to identify how DIVERSIFOOD seed savers' and farmers' networks manage their data: ProSpecieRara (PSR) in Switzerland, Réseau Semences Paysannes (RSP) in France, Rete Semi Rurali (RSR) in Italy, Red Andaluza de Semillas (RAS) in Spain and Arche Noah (AN) in Austria. The findings of this survey are presented below. Milestone MS24 gives more details on methodology and results.

Each organisation works with different categories of varieties from the public domain (e.g. local varieties, landraces, new farmers varieties/populations or registered varieties), covering many species including cereals, forage crops (grasses), legumes, potatoes, beet (sugar, fodder), oilseed crops, fibre crops, vegetable crops, ornamental crops and trees. All five organisations record data about varieties grown in different locations and/or over a period of several years, store information about agronomic performance, and results of organoleptic trials. The information collected includes farmers' personal data and extensive data about the varieties: country of origin, information about their sources, date of entry of the accession, seed lots, plants in the seed lots, photos, location of multiplication, field within that location, history of seed lots within a network, climate where the accession are grown, traditional knowledge linked to the varieties, traditional uses, local names, etc. Some are close to institutional standards: AN and PSR have EURISCO passport descriptors for all accessions, while RSR uses Bioversity International descriptors for farmers' knowledge. On the other hand, RSP and RAS do not use any standards, rather they have drawn up their own descriptors. Milestone MS24 give examples of descriptors used by the organisations. In all cases, databases are seen as one of the key elements of the organisation and are often in daily use. For AN and PSR, the database is the core of their operation, while for RSR, RSP and RAS, the database is becoming an increasingly important tool. Regarding accessibility to data, two different approaches are used: the data is available to everyone (open access) or access is limited to a group, with password protected (online) access. There are also differences in the availability of raw and processed data: several reports with analysed data are freely available for all organisations, but there is no access to the raw data. RSP is an exception here, with its Spicilege on line database (<http://www.spicilege.org/>). Important questions regarding big data (i.e. the amount of data normalised and organised in a centralised database) and data mining in CSB functioning are currently the subject of debate. A pertinent aspect is how these tools are handled within an organisation, concerning breeding and biodiversity management (traditional knowledge versus numeric data, etc.). For example, in the context of research programmes, data collected through on-farm trials or questionnaires and analysed, and molecular data produced, need to have a clear status regarding ownership and accessibility. Establishing the status must be done with the help of a data management plan as an integral part of the consortium agreement. Furthermore,



the political environment regarding patents on genes, based on numerical data, is a threat to biodiversity cultivation and use. There is a need for further legal work on the status and ownership of the data in relation to the Nagoya protocol and the International Treaty on Plant Genetic Resources for Food and Agriculture. Financial support is also needed for the maintenance of organisations' databases and to ensure data quality. DIVERSIFOOD offers several data management solutions which may be useful for new CSBs. CSBs who wish to organise their data in a database can ask for advice, find out if software that matches their needs already exists. Often such software is under an open source licence and is freely available (e.g. <https://sourcesup.renater.fr/projects/shinemas/>). A community on data management and use could be created. This community could improve existing software, exchange experience on how to process data and develop good technical and legal practices.

### **3) Survey on CSBs in Europe**

Community Seed Banks are diverse and dynamic experiences that share some common features. They are collective seed management experiences embedded in the so-called informal seed systems to counteract the loss of locally adapted varieties. Often they are well established local and grass root initiatives developed by networks of farmers, gardeners and citizens that have a technical, political and management capacity that is key to practice the sustainable use of agrobiodiversity. Community Seed Banks have the main aim of (i) enhancing access to seeds and plants adapted to local conditions or alternative farming systems, (ii) providing training and awareness to local communities on the issue of agrobiodiversity loss, (iii) managing farmers, gardeners and citizens' networks around the issue of seeds, (iv) helping to build more sustainable food systems and make the society more resilient. More than a specific definition, it is the combination of those features that defines Community Seed Banks experiences. They can have diverse governance structures, areas of activities and stakeholders involved but they are all contributing to a process of innovation based on communities' sovereignty on local resources. The CSBs initiatives work with a wide range of crops and varieties, including local and farmers' varieties, old commercial varieties and populations. This type of activities requires financial resources, manpower and technical equipment that are not always available in CSBs initiatives. In addition, often the legal environment represents an obstacle for the development of such initiatives. However, voluntary work and punctual funding opportunities have been used by existing experiences to carry on their activities and develop innovative seed systems, thanks also to cooperation and networking between initiatives with similar goals and values.

The DIVERSIFOOD project worked on the issue of Community Seed Banks with a global approach through different events. Firstly, a survey on CSBs experiences in Europe was conducted as innovative contribution of the project to the specific issue, and then a workshop with the participants to the survey for discussion and validation of survey results was conducted on 21 September 2017 in Rome, Italy. The following day, on 22 September 2017 a workshop to discuss with International Institutions about the issue of Community Seed Banks was held at FAO HQ in Rome, Italy. In October 2017, a side event on CSBs experiences from North and South was held in Kigali, Rwanda during the Governing Body of the ITPGRFA. Finally, on 24 July 2018 representatives of the DIVERSIFOOD project participated to the Informal Dialogue Building Linkages to Strengthen On-Farm management of Farmers' Varieties/Landraces: Community Seed Banks, organised by the Commission on Genetic Resources for Food and Agriculture (CGRFA) at the FAO. Reports of the whole process can be found online on the DIVERSIFOOD website ([www.diversifood.eu](http://www.diversifood.eu)) and on the website [www.communityseedbanks.org](http://www.communityseedbanks.org)

### **4) Survey on gene banks and users (LINKAGES)**

LINKAGES was a joint project between DIVERSIFOOD and ECPGR. It circulated two surveys, one among genebank curators and one among on-farm representatives (farmers, seed savers, and their collective organisations), to gather data on how "direct use" germplasm requests were handled. While defining direct use was challenging, we kept the definition quite broad, intending to capture all those requests for germplasm which do not fall within the conventional research/breeding pipeline but are rather made to genebanks by individuals or communities who

wish to embed crop genetic diversity in their on-farm sustainable production or participatory research endeavours.

### **Ex situ findings**

We received 45 complete answers from genebank curators in 21 countries, covering a range of different crops and distributing an average of around 100-200 samples per year. With just one exception, all genebanks have received “direct use” requests for germplasm, and these types of requests were reported to be increasing by half of our respondents. Most “direct use” requests came from farmers and seed savers, and a relatively smaller proportion from their associations or organisations. While most curators declared not to have a specific policy for dealing with direct users’ requests (70%), around a quarter of our responses indicated they had a specific policy in place, although not all specified what it consisted in specifically. The use of the SMTA was quite frequent even in dealing with direct users but often in a simplified form, while around 22% of curators stated not to be using a transfer agreement at all in these cases. Finally, in terms of collaborations with the on farm world, the majority of genebank managers answered positively, being engaged more or less sporadically with on farm actors and farmers in projects or networks.

### **On farm findings**

We received 45 complete answers from “direct users” in 8 countries, covering a range of different actor types including farmers, farmers associations and technicians working closely with local farmers. Respondents are equally involved in commercial organic/biodynamic production as well as on farm conservation of landraces and breeding/selection activities. Most of the respondents already experienced an interaction with a gene bank to request seeds and the vast majority obtained the material requested. An intermediary organisation or network often helped individual users with the request. The promotion of a specific variety through collective processes and seed exchanges was the main purpose for which the respondents asked for germplasm. A large proportion (over 75%) of surveyed direct users declared a high level of satisfaction with the material received, while some dissatisfaction were expressed in terms of the associated information. Finally, more than 40% of the direct users reported being engaged with one or more ex situ institutions in collaborative projects or networks.

A workshop was organised on 4-5 June 2018 for discussing the following issues:

- Do we have a shared and common view of what can be considered a “direct use” request and of what kind of actors are making these types of requests?
- Which specific agreements or policies are in place (if they differ from the default ones) for direct use requests (what do “simplified SMTAs” look like? Are they reported to the Treaty’s Governing Body or other relevant institutions in a similar way as “normal SMTAs”?)
- How does the ex situ community see the “direct users” communities they serve, in terms of potential collaborations and synergies in carrying out conservation and innovation around genetic resources?
- Who are the “direct users” interacting with the ex situ community? Are they perhaps not only private farmers/gardeners but actors embedded in communities where meaningful on farm conservation and experimentation take place?
- How can we improve the interaction between these direct users and the ex situ community and how could this contribute to an integrated strategy for conservation and sustainable use of plant genetic resources?
- What can be the role of “direct users” involved in collective processes and seed exchanges in agrobiodiversity conservation policies? Could their activity become complementary/synergic to the one of the ex situ community and how to foster this?
- How can knowledge exchange between ex situ and on farm actors involved in collective experimentation/innovation processes improve the information associated to crop germplasm?

The meeting had the following outcomes:

- I. It would be important to create future moments for more exchange/interaction between ex situ /on farm communities around concrete issues such as:
  - a. Improving the varied scenario of MTA/SMTAs currently used by on farm communities for material exchange, ensuring the possibility of interactions with genebank collections and modalities;
  - b. Possibility of integration/communication (with careful consideration of privacy issues) between the databases used by on-farm networks and communities and those used by ex situ genebanks;
  - c. Pilot projects on multiplication/dissemination of ex situ germplasm of interest to on-farm communities and/or small-scale organic farmers.
- II. Opportunities for these continued exchanges and interactions could be offered by ongoing EU-funded projects focusing on synergies between ex-situ/in-situ/on-farm conservation approaches and communities, namely the DYNAVERSITY and FARMERS' PRIDE projects in which some LINKAGES partners are involved. RSR is part of the Dynaversity project and will take care of embedding the issues emerging from LINKAGES into this project, finding opportunities to research them further. Other opportunities can be offered by seed networks' farmer field days and visits to experimental fields, which could allow ex situ personnel to better get acquainted with the possibilities offered by seed / farmer networks in terms of germplasm evaluation / characterisation. Dedicated meetings of the ECPGR working groups can also offer opportunities for deepening some of the aspects emerging from LINKAGES. Working group members / chairs are called to make these spaces available when they see the opportunity.
- III. Set up a new international journal for publications focused on participatory, "informal", decentralized research on organic agriculture, seeds and agrobiodiversity. The International Treaty had proposed something similar some time ago and the ECPGR is planning something along these lines within the framework of a newly established EU research project. It would be good to have someone from the European seed networks represented in the editorial board together with experts from genebanks, so to work together on evaluating research results, which come from both worlds.
- IV. Develop a pilot project proposal involving selected national genebanks and on farm networks to test the evaluation / characterisation of priority germplasm sets of interest for organic, small scale agriculture in farmers' fields and sharing of the resulting data (with intellectual property considerations) with mutual benefit for farmers and genebanks. This could be a first step towards establishing an "alternative" evaluation network capable of incorporating the need for formal scientific reliability and the participatory advantages of working directly in a more informal, on-farm context, establishing new integrated research protocols.
- V. Develop the basis for an ex-situ / on-farm "alliance" (definition, structure and mandate to be defined), which could stem from the above interactions and joint activities, and become a steward of a more integrated vision of agrobiodiversity conservation and contribute to stronger implementation of the International Treaty's Articles 6 and 9 on sustainable use and farmers' rights in Europe.

## **5) Enabling workshops**



A multi-actor workshop series was developed and implemented as scheme for regulatory awareness on crop biodiversity products in EU member states and candidate countries. Crop biodiversity products are seeds, plants, food, feed and other products deriving from underutilized crops. Biodiversity products can have a positive impact on farmer's income, quality of nutrition, climate change adaptation and their production includes the most effective way of conserving genetic diversity. Legal barriers are in many cases hindering the access of crop biodiversity products to the market.

Six workshops took place from July 2016 to December 2017 in six EU member states. Qualitative and quantitative feedback were collected from participants. Overall, 277 participants from 25 countries (4 non-EU) took part, in average 45 persons (32-59) per workshop. The exchange of experience between actors was emphasized as beneficial equally by officials and civil society representatives, as seed legislation and implementation highly depend on national fora and official procedures. Practical projects and presentations delivered by farmers were useful and efficient to emphasize the importance of enabling legal environments. In at least one country, the multi-actor workshop was followed by a process of adaptation of seed legislation towards more space for crop biodiversity actors.

### **Main outcomes coming from the workshops:**

- 1) Create communication platforms between stakeholders on PGRFA and seeds. Missing communication streams between stakeholders, leading to a lack of understanding of each other's motivation, and the large influence of the seed and food industry on legislative processes were identified as the main barriers for the marketing of crop biodiversity products, alternative seed systems and efficient on-farm conservation. Communication between the main stakeholders of seed and genetic resources conservation must be institutionalised at national level. Main stakeholder groups are farmers and farmer's associations, Community Seed Banks, other civil society organisations, gene banks, seed authorities and relevant ministries. Facilitation is needed to find a way forward. One applicable solution is to put in place institutionalised national platforms in which all stakeholders, institutional or civil society-based, can discuss and negotiate PGRFA issues like proposed in DIVERSIFOOD Innovation Factsheet #10. Stronger communication on legal issues is also needed between actors from different member states (see following paragraph) and at EU level. At EU level, civil society organisations should have more possibilities to participate meaningfully in decision making, also with regards to technical questions as discussed in the EU Standing Committee on Seeds and Propagating Material.
- 2) Exchange best-practice examples of member states' implementation of EU seed marketing regime. Due to the complex nature of the current EU seed marketing regime consisting of 15 directives, the effects of this legislation strongly depend on their national implementation. Derogations and flexibilities that make space for biodiversity are in many cases not transposed at all, or very partially in national laws. On the other hand, some member states (e.g. Denmark, Austria) have developed enabling solutions within the current European overarching framework. Lacking a coherent and cohesive EU approach, efforts must thus be taken to allow for the exchange of best practices between member states. Interregional multi-actor workshops, which regroup member states and candidate countries, have proven to be excellent tools to promote biodiversity-friendly legislation and to build a strong basis for the inclusive institutionalisation of civil dialogue in the field.

- 3) Improve seed legislation. The current EU Plant Reproductive Material framework is restrictive, as it does not allow for derogatory rules for short value chains, and de facto does not support farmers' seeds. Seed legislation in every member state must allow for the exchange and local marketing of seeds (of any non-registered material) by farmers as well as the exchange and marketing aiming at the conservation of PGRFA. For this purpose, in a first step and lacking a coherent EU framework, every member state shall implement the derogations in the current framework, putting high emphasis on the notion of "commercialisation", and delineating activities whose primary purpose is the conservation and sustainable, local use of agrobiodiversity outside of the Directives' scope. This can be a first step in the fulfilment of Farmers' Rights as set out in the International Treaty on Plant Genetic Resources for Food and Agriculture, and thereby support the use of genetic diversity on farms and create conditions for locally-adapted and resilient farming systems. Currently European seed laws hinder the sustainable use of PGRFA and work against the availability of organic seeds by putting high barriers to seed producing actors, especially SMEs, due to obligatory pre-market controls (DUS and VCU testing). The new EU organic regulation will open further legal space for crop biodiversity on organic farms. In the framework of this regulation, the marketing of organic heterogeneous material (OHM) will be allowed after simple notification, without having to comply with the requirements for variety registration, and the certification categories of pre-basic, basic and certified material or with the requirements for other categories set out in several Council Directives (Article 13). Actors present in the workshop series have all highlighted that a broad definition of OHM is needed, and should include all kinds of populations used in diversified agricultural systems, whether the result of targeted crosses between individuals, or of wider crosses between populations.
- 4) Improve administration and lower financial barriers for small actors. Many barriers for the marketing of crop biodiversity products are not stemming from legislation itself, but from the administration, which is in many cases too bureaucratic and sets additional limits, with regards to financial and human resources to be mobilised by small actors. Examples are the big differences in registration fees for amateur and conservation varieties and also the kind of data (sufficient description) required by the national authorities for the application. These barriers shall be removed, by continuing exchanging best-practice examples (see recommendation #2) as well as awareness raising and training amongst civil servants. Education and training for civil servants on the special nature of these genetic resources to implement the changes on the ground should definitely become a priority. A shift from saving a "frozen original" of a variety towards the saving of "original characteristics" is needed to take into account the continuous evolution and adaptation of these varieties. Regarding descriptions for application, national gene banks should provide technical assistance to other actors for describing the characteristics of amateur and conservation varieties.
- 5) Create practical support schemes for diversification and community biodiversity management. During the EU Common Agricultural Policy (CAP) period 2014-2020 some EU member states have developed measures within the agro-environmental schemes in Pillar 2 supporting amongst others on-farm conservation and development of PGRFA (Article 28, sub-measure 10.2). Missing awareness amongst farmers and high entrance barriers (e.g. minimum area grown per variety) are in many cases hindering positive effects of these measures. The latest reform proposal for the CAP, submitted by the European Commission in July 2018 (12), is largely silent on the topic of crop genetic diversity, and it only foresees that Members States

can design support measures for farmers that increase crop diversity if chosen as a national priority. On the contrary, outcomes from DIVERSIFOOD workshop series clearly suggest that the aspects of agrobiodiversity and community biodiversity management shall be obligatory to be implemented in support measures. Member states shall design support policies that fairly compensate collective action of farmers for maintaining and increasing agrobiodiversity especially taking into account the lessons learned from the current CAP period.

## **6) The Treaty negotiations**

An entire article of the International Treaty on Plant Genetic Resources for Food and Agriculture ([www.planttreaty.org](http://www.planttreaty.org)), a legally binding international agreement adopted in 2001, is devoted to Farmers' Rights (Art. 9). The key objectives of the Plant Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture, facilitated access to these for research, breeding and training purposes, and the equitable sharing of the benefits derived from their use. Protecting and enhancing Farmers' Rights is crucial to achieving the Treaty's objectives. Realising Farmers' Rights means enabling farmers to maintain and develop crop genetic resources, and rewarding them for their indispensable contribution to agrobiodiversity worldwide.

More than 140 countries that are parties to the Plant Treaty recognise that the past, present and future contribution of farmers in all regions of the world in conserving, improving and making available crop genetic resources constitutes the basis of all food and agriculture production, and of Farmers' Rights. The Plant Treaty provides some general directions and recommendations on how to implement Farmers' Rights: the protection of traditional knowledge; the right to equitable benefit sharing; the right to participate in relevant decision making at the national level; the rights to save, use, exchange and sell farm-saved seed and propagules. However, the responsibility for defining and implementing Farmers' Rights is placed with national governments. While the Plant Treaty does not oblige member countries to adopt any specific norm for Farmers' Rights, its provisions, however, provide an important framework for the development of relevant national policy measures. The DIVERSIFOOD project aimed at contributing to the development of meaningful policy frameworks.

The norms on Farmers' Rights are shaped in an ongoing process under the Plant Treaty. The Governing Body of the Plant Treaty is its highest decision-making body and convenes biennially. At each session, a resolution is adopted on Farmers' Rights, reflecting the consensus among the contracting parties. Between the sessions, international multi-stakeholder consultations are held. DIVERSIFOOD-partner Fridtjof Nansen Institute (FNI) of Norway has been centrally involved in most consultations to date, as co-organiser and/or co-chair, and participates in the sessions of the Governing Body as well. Central recommendations from the consultations concern the participatory development of voluntary guidelines for the realisation of Farmers' Rights, and recommendations for improving national legislation so as to enable a balanced regulation for all types of seed and seed systems.

A breakthrough was achieved at the 7th Session of the Governing Body of the Plant Treaty, held between 30 October and 3 November 2017. After 10 years of negotiations, an expert group was set up to develop options to encourage and guide the implementation of farmers' rights related to seed and propagating material. Regine Andersen participated as an expert in the Norwegian delegation to the 7th Session of the Governing Body. She was elected co-chair of the Contact Group that was mandated to negotiate the decisions on Farmers' Rights, together with colleague Godfrey Mwila from Zambia. Throughout the week, Andersen facilitated negotiations as well as contact between the parties between the meetings of the Contact Group in order to help the parties arrive at a consensus. The proposals to appoint an

expert group and formulate voluntary guidelines that were raised by the delegates, were based on recommendations by the co-chairs of the *2016 Global Consultation on Farmers' Rights* in Bali, Indonesia, organised by the governments of Indonesia and Norway and the Secretariat of the Plant Treaty. Andersen was co-chair together with her colleague Carlos Correa from Argentina. The two facilitated consultations among 95 participants from all regions and central stakeholder groups over three days and developed the recommendations reflecting the discussions. Andersen also presented the results of the Bali Global Consultations on Farmers' Rights at a side event at the Seventh Session of the Plant Treaty on Tuesday 31 October 2017 in Kigali. More than 80 participants from all central stakeholder categories were present. The side event also featured the work of the Treaty Secretariat to implement the Treaty provisions on Farmers' Rights as well as the experiences of several countries and stakeholders in this regard. In addition to this, Regine Andersen organised a side event on community seed banks, sharing experiences from the North and South, which resulted in a report published by DIVERSIFOOD.

Meanwhile, the *Ad Hoc Technical Working Group on Farmers' Rights* under the Plant Treaty has been established and has had its first meeting. From Europe, DIVERSIFOOD partners have two out of five expert members of the group, Riccardo Bocci (Rete Semi Rurali) and Regine Andersen. At the first meeting, the groundwork was carried out to do an inventory of farmers' rights and collect examples for best practices. At the next meeting, options are to be derived from the collected examples. DIVERSIFOOD partners have been central in the international negotiations on Farmers' Rights under the Plant Treaty.

## 7) The role of modelling

A participatory approach has been developed to model the functioning of community seed systems (CSS) in order to: 1) foster their **empowerment** in the management of crop diversity through a reflexive approach; 2) highlight the **genetic diversity, diversity of practices** and **organisational diversity of CSSs**.

### Background

Sustainable farming in the context of global change should be based on diversified agro-ecosystems, including crop genetic diversity, as it generally offers better resilience to changing environmental conditions. Seed circulation between farmers is a major driver of the dynamics of genetic diversity over time. Although several studies have shown that seed flows between farmers have a strong influence on the evolution of crop genetic diversity, there is a lack of knowledge on how **seed circulation, farmers' practices and local selective pressures interact to shape the structure of crop genetic diversity** over time. Over the past twenty years, community initiatives involved in the management of crop diversity – called Community Seed Systems (CSS) - have emerged in Europe. Among those, farmer seed networks or community seed banks now include more diverse actors in addition to farmers, such as gardeners, small seed producers, etc. It is interesting to document to which extent these diverse CSSs shape the genetic diversity of crops.

### Objectives and approach

DIVERSIFOOD objectives are: a) to support a reflexive approach to CSS actors to help them in organisational decision-making; b) to develop scientific expertise on on-farm diversity management strategies based on collaborative work between researchers and actors of the seed networks. For that, **simulation-based approaches** are good alternatives to surveys and experimental studies that are very cumbersome and costly to conduct, and analytical approaches that are difficult to implement in such complex systems.

*Tools and methods developed in DIVERSIFOOD:*

- A simulation software (CropMetaPop) to model the evolution of the genetic diversity of cultivated populations by taking into account growers' practices and their social organisation;



- A demo-genetic analysis pipeline to analyse the model outputs and represent them graphically.

*Approach:* Meetings were organised with the facilitators of the CSSs in France (RSP), Italy (RSR) and Spain (RAS) to document the species and varieties they manage, their growing practices, seed circulation rules and organisational characteristics. This information allowed to co-construct scenarios for community-based management of crop diversity. Initial scenarios were simulated and the results discussed with the facilitators. New scenarios can be proposed from these discussions in an iterative process.

### **Main results**

The theoretical case studies showed that seed circulation among actors allows maintaining the survival rate of the populations close to one and therefore helps to avoid the extinction of the metapopulation in the long term. At the genetic level, in the cases with large population size, the type of seed circulation network has had little impact on within-population genetic diversity or on the genetic differentiation among populations. This was due to the fact that these indicators remained quite stable due to the very limited impact of genetic drift. However, for cases with a smaller population size (e.g. tomatoes or cabbage for which less than 100 plants per population are generally grown by farmers), genetic drift reduced significantly within-population genetic diversity and increased dramatically among populations genetic differentiation. In these cases, the type of seed circulation network did not change within-population genetic diversity but significantly reduced genetic differentiation. Centralised networks appeared to have the strongest homogenizing effect probably due to a limited number of actors distributing seeds to everyone. In the real case studies experience, interviews with farmers and farmers' organisation facilitators were essential to describe the general trends and specificities from one CSS to another. Although the approach was conducted with four CSS located in three different countries and managing two different crops, the results consistently showed that all in CSS, very diverse and contrasted local conditions were met in terms of both environments and practices. By contrast, a similar general dynamics of seed circulation was observed among the CSS, with the organisation changing from star network to community network when the number of actors increased. For the more advanced case study in Italy, first modelling results highlighted a trade-off between the two processes: heterogeneity of local conditions vs organisational changes. This research also highlighted how community seed systems are complex and adaptive systems that require an iterative process to translate complexity into relevant modelling settings.

### **Outcomes**

The widespread use of participatory modelling in many CSSs will increase: the empowerment of the communities, and the visibility of on-farm management of crop diversity. The collaboration between modelling scientists, farmers and farmers' organisation facilitators are essential to properly describe social and evolutionary processes in such systems. These findings encourage to increase the number of case studies to capture a broader diversity of initiatives at the European scale and even on a larger scale in order to provide a more realistic picture of what is going on in on-farm management of crop diversity. Theoretical developments in statistics are essential to make the link between co-constructed scenarios and read data.

This participatory approach based on co-designing scenarios of community seed systems functioning showed that the collective dimension of CSS is key to seed circulation which allows for crop diversity development and maintenance. Therefore, this is important to support the collective organisations involved in the management, conservation and breeding of crop genetic diversity. The second pillar of Common Agriculture Policy should include in the article promoting biodiversity the financial support for these collective organisations. This support should be conditional on the type of diversity they manage, the number of people involved in the organisation and their networking activities (number of meetings and events). Description of these actors should not focus only on the type and the amount of resources



they hold and their accessibility but also if actors are collective organisations or individuals. In the first case, the actor should confirm they have networking activities. Regions and municipalities should implement long-term financial support to local community seed systems.

## 8) Workshop on policy recommendations (Sevilla 2019)

During the last annual meeting in Sevilla, DIVERSIFOOD partners organised a dedicated workshop to WP4 outcomes. The aim was to check agreements and disagreements around two main topics relevant for policy recommendations: community biodiversity management (CBM) and the seed systems approach. The WP leader presented the importance of using the term CBM instead of only conservation and the aim of analysing seed systems with a graphic outline. In fact, DIVERSIFOOD looked at seed breeding and production with a wide perspective that includes the whole seed system, integrating different activities: from the searching for new varieties to the seed marketing, from the participatory research to the possible relationships that can be developed with the private sector and the market to valorise the production derived from agrobiodiversity. Modelling the different actors covering different roles, allows describing seed systems as shown in figure 2. The activities described in figure 2 points out that seed systems are complex and made of different actors with contrasting behaviours. For example, farmers can be at the same time only consumers of seeds and innovation (e.g. new varieties) produced by other actors (e.g. seed companies, private or public breeders) or can be a key player in producing their own seeds and new varieties through participatory plant breeding. The same is true for public gene banks or public breeders, they can collaborate with the so-called formal systems (the right part of the figure) but at the same time they can promote and sustain local and collective seed systems (the so-called informal ones).

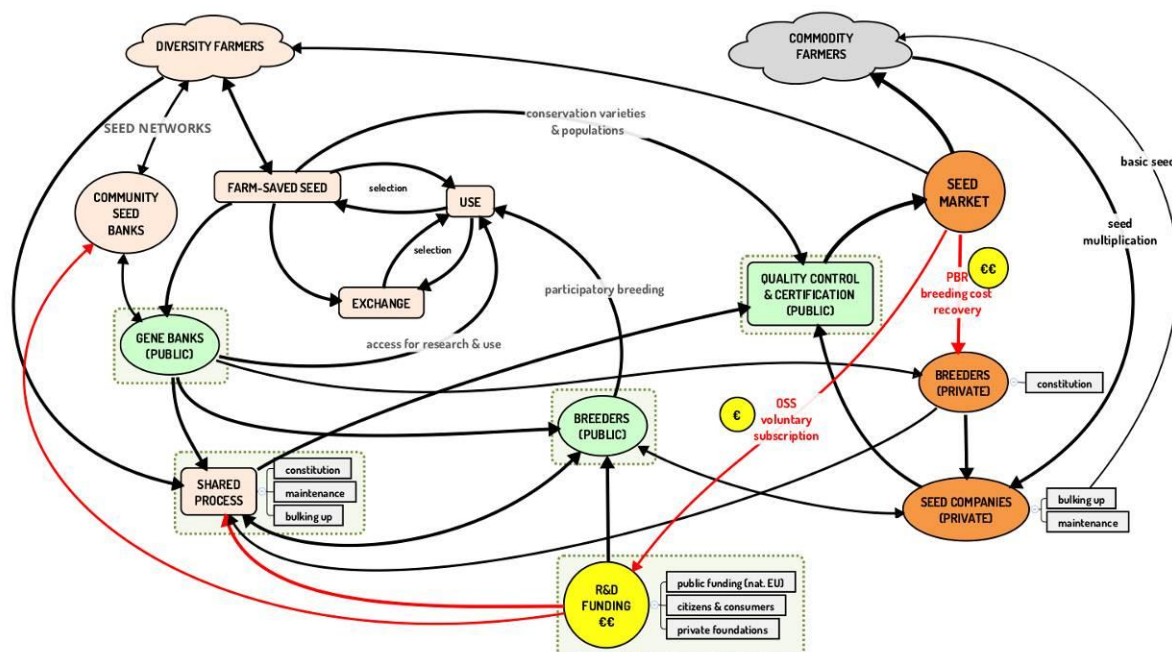


Figure 1 : The overall seed system

Then partners had the possibilities to express their views or comments in the topics. Below the brief summary with all the outcomes.

Regarding CBM these were the main comments:

- a. It is important to agree on a word / definition that reflects exactly what we are working with. It came different suggestions:
  - i. Community cultivated management;
  - ii. Community based agrobiodiversity management;

- iii. Collective management;
- iv. Explain and specify what does mean “agrobiodiversity” in our context. Because maybe it is too broad, including crop wild relatives and animals.
- b. In the schema CBM (Figure 2), presented in the next section, we can include “market” / value chain / food systems, so as to specify that conservation is linked to marketing and that the challenge is to bring back diversity to the supply chain;
- c. Presenting the idea of innovation as a social process and not only a product.

Regarding the seed systems approach these were the main comments:

- a. Formal vs. informal:
  - i. It is important to realise that there are still boundaries between the systems, so it is better to say that there are some overlaps;
  - ii. Many actors are working in both systems;
  - iii. It is not a matter of having an integrated system but to realise that seed systems are complex, dynamic and made of different actors with flows of germplasms, knowledge and money among them;
  - iv. What we call informal systems are in fact formalised, with their rules: that do not follow institutional standards: we have to better define and describe our systems depending on countries and local context. A more positive term is needed to create public support for the “informal” seed systems.
- b. We can include type of crops / seeds in the scheme, underlying not only the type of actors but also the type of plants they are working with;
- c. We can include power-relationships in the seed system approach in the picture, showing the unbalanced power related position of the different actors, maybe by using different colours?
- d. Most of the partners agreed that the dualism formal / informal is not more relevant because even so-called informal systems have a set of rules and the same actor can play in both systems. Moreover all agreed that is important to describe actors processes and flows using a seed system approach, because it simplifies the comprehension of them and it could promote the recognition of all the actors involved. There is a risk that when we describe a system, the authorities want to standardise or formalise the practices in order to fit to the scheme.

## Recommendations

### 1) A paradigm shift from conservation to community biodiversity management

DIVERSIFOOD focussed on the word “community” as a key element of on farm management strategies. Communities, and in general social aspects and norms, play an important role in establishing and shaping seed systems at local level and this role should be recognised also by policy makers and scientists. For this reason, we suggested to include S (social aspects) in the classical formula Genotype\*Environment interaction: diversity is not only the result of one variety (several genotypes within a heterogeneous population) in one environment but also of their interactions with social aspects, considered in a wide sense (e.g. social organisation of the community, social preferences regarding food). At this regard, scholars developed the concept of Community Biodiversity Management (CBM), putting farming communities at the centre of the sustainable use of agrobiodiversity. The main aim of this approach is to show how supporting community institutions and strengthening their capabilities is paramount for achieving the sustainable use of PGRFA. DIVERSIFOOD project looked at the application of the Community Biodiversity Management approach in Europe, learning from existing experiences of multi actor networks working at local level, and understanding how the policy and legal environment can impact on the local systems. As shown by the following figure this approach can include different activities and ways of managing diversity: community seed banks, participatory plant breeding projects, artisanal and local seed companies and cooperatives, landraces conservation and management, seed exchanges and fairs.



Figure 2: The activities included in CBM

### 2) New actors: the role of community seed banks

In between farmers and gene banks, DIVERSIFOOD considers Community seed banks as the missing link for successful PGR conservation. Community seed banks (CSBs) are collective actors that can facilitate access to plant genetic resources (may they be still in use or from public gene banks or participatory plant breeding), multiply seeds, promote seed exchange and maintenance and create new genetic diversity for sustainable agriculture.

### 3) Maintaining flows, evolution and diversity

In order to maintain sustainable seed systems, it is paramount to promote their diversity, facilitating the flows of germplasm and knowledge amongst the different actors by appropriated rules and policies. Especially a full benefit sharing within the Treaty as well as guarantee against biopiracy risk and the end of patents on living organisms and their parts. It will allow to have diverse farming systems where evolutionary forces will continue to play a role in the selection of the best adapted varieties during the time.

## Annexes

### 1) National platforms

In the report, national biodiversity management systems have been examined out of the perspective of five civil society organisations (CSO) from Spain, France, Italy, Austria and Switzerland. The results have shown that although the CSOs are well connected to public institutions like agriculture research centres institutes or national genebanks, national platforms that are organised and coordinated by public authorities are mostly lacking. Some of the CSOs report that they have well established links to the national ministries but these depend rather on personal relationships than on established national structures that support direct exchange between the different stakeholders of the national PGR management system. One of the oldest and most developed national platforms we could find exists in Switzerland, where since more than thirty years almost all stakeholders of the plant genetic management community collaborate along a common strategy and a national action plan for the conservation of plant genetic resource for food and agriculture (NAP-PGRFA) based on the global action plan developed in Leipzig 1996.

Beside this example, coherent national strategies for the management of the diversity of PGR that are based on long-term implementation strategies and where adequate financial resources are allocated to the realisation of national action plan for the safeguard of PGRFA are missing in almost all European countries.

The factors that are responsible for the lack of national platforms are manifold:

- Lack of financial resources
- Lack of trust between the stakeholders
- Lack of long-term implementation strategies
- Lack of a coherent seed policy that supports the concept of diversity management of PGRFA (seed legislation, phytosanitary restrictions, high administrative burdens for seed exchange, etc.)
- Lack of transparency, e.g. very complicated application procedures for project supports
- Lack of recognition for the different stakeholders already involved in on farm diversity management activities and
- Unclear share of competences or unwillingness of collaboration between different ministries or regional and national authorities.

Thanks to Horizon 2020 projects like DIVERSIFOOD the collaboration between and within different partners and stakeholder groups involved in biodiversity management have improved a lot on an international level. Ties between them have become stronger and will be able to last over the duration of a project phase.

### 2) Seed as Common

A common represents (i) a resource (the seeds), (ii) a community associated to its production and management and (iii) an organisational mode associated, that is to say a set of rules, a deliberative body to ensure the conflict management, and ways to its implementation. According to Elinor Ostrom, the property is the combination of five types of rights: the right of access, the right of withdrawal, rights to influence the collective choices regulating, the right of management, the right of exclusion and right of alienation. These rights are independent of each other and together form a "bundle of rights". Property is not defined as an absolute right of a person on one thing. It is relative and can be shared among several actors linked by a complex set of social and legal. The commons invite to think in terms of rights, and not in terms of ownership. It is an alternative to intellectual property right such as plant breeder right or patents as well as open source licence. Seed management based on the concept of commons propose a third way. This thematic has been investigated by Réseau Semences Paysannes and it appeared that several Maisons des Semences Paysannes (Community Seed Bank) manage their seeds based on the concept of commons. For example, Pétanielle, in Midi Pyrénées in France, which is an association, that bring

together farmers and gardeners in order to conserve and develop cultivated biodiversity mainly on cereals to make bread. Pétanielle members settled a set of rules to manage their seeds. For example, gardeners give back part of the harvest in order to feed a security stock to diffuse varieties. A collective harvest is organised each year in order to note the varieties and agree on the organisation of next year. Each variety is distributed to several gardeners to conserve it. Diffusion of few kilogrammes of a given variety to farmers is normed by a sponsorship convention signed by both parties (an old and a new member of the association): a farmer must note the behaviour of the variety and give back the amount of seeds received ready for sowing to another farmer that may want this variety.

### **3) ABS and MTA the experience of Arche Noah**

*EU Regulation 511/2014, which implements the user compliance aspects of the Nagoya Protocol in the European Union, places significant new legal requirements on the use of genetic resources, defined as research and development, including genetic characterisation and participatory plant breeding. Users are required to make sure that any genetic resources they use were accessed legally in the country of origin and to contractually agree benefit-sharing terms with that country, if the country requires them. Furthermore, users are required to pass on and retain certain information relating to the resource and any benefit-sharing terms when they transfer it to others. These obligations thus require all genetic resource users, whether small or large, to rethink their internal documentation and working methodology, setting up an internal Nagoya compliance system.*

Since 2015, Arche Noah has been engaged in developing such a system, and has formally recognised that it had an additional moral obligation to ensure that the genetic resources held in its Seed Archive, as quite a large upstream private collection, were compliant with all applicable national access laws around the globe. That is why the association has carried out so-called “compliance checks” within its Seed Archive and its breeding projects, retracing, to the best extent possible, the origin of the resource, its country of source and/or origin, and the date in which it was collected / entered into the collection. This research was then compared to a country table prepared by the policy team, which outlined applicable access laws in the countries defined as source or origin for each genetic resource, taking into account the special status given to crop biodiversity, on account of the ITPGRFA, when applicable. On the basis of a decision tree, the Association flagged the (quite few) resources where the origin could not be reconstructed, or where the resource had been collected without a permit or authorisation in a country that required one. These flagged accessions are not any longer distributed by the Archive for research and development purposes, nor are they used in our own research projects. Arche Noah’s fruit collection is currently carrying out the same exercise.

In addition to this centralised compliance check, Arche Noah set up templates to help the members comply with their obligations, accompanied by communication and training. A new simplified form was developed in 2019, the “Plant Visa”, which records information regarding a resource to enable the association and members to collate and pass on the legally required information, e.g. its country of origin, description, and any benefit-sharing terms from the country of origin that apply to its use.