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AGRICULTURE & INNOVATION



# EIP-AGRI Focus Group

## Agroforestry

MINIPAPER 3: Tools for Optimal Design and Management  
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### Authors

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## Introduction

Agroforestry (AF) so far is not a well-known and widespread way of agricultural production in Europe, with barriers such as legal issues, unpredictable financial outcomes, etc playing an important role here. But even for those who would opt to implement AF, it's generally not easy to find or to have access to guidelines and tools for the design and management of such a system.

Therefore in the further promotion of effective agroforestry systems (AFS) in Europe, an increased awareness of the existence of and the development of new design and management tools for farmers would be an important step forward.

A well-organized system of tools could represent a kind of „guide“ - accompanied with access to relevant information (databases, sources of structured and practical knowledge), and further tools (business plan, financial analysis, etc) -, that leads the farmers' way through the process of decision-making and to the installation on the field.

However, always keeping in mind that there is no such thing as the “universally” valid rules or guidelines, and that so many details remain case and context specific. Christian Dupraz shares with us his view on this challenge:

*“To predict or not to predict? When a stakeholder considers adopting agroforestry from scratch, endless questions arise. How many (trees, crops, animals, workers, time...), where on the farm, what design, what to be changed from usual business, aiming for money or pride, for production or carbon sequestration, for biodiversity or biomass? And the would-be agroforester turns around looking for answers from the local expert, from the landscape, from the politicians, from the elders who remember. Or why not, from the researchers and extension officers. But they usually look at their feet... or let's say the soil... quite embarrassed. Global questions, but so many detailed answers required, difficult questions as the answers are very site-specific and address distant times. This is where the “big model of everything in agroforestry” would be so convenient. We, at INRA, are dreaming on such a model since 2002. And it is still not available. We apologize. It probably will never be. However, we learned so much by trying to incorporate all the knowledge that we gained from experiments and know-how of farmers in that model. This is probably the way to go with agroforestry: think globally, and plant locally. Don't expect too much from tools, visit pioneers farms, and be ready to tell others about your achievements and mistakes. Agroforestry is participatory: share, compare, compete, just like farmers who managed old-times agroforestry systems did. Predicting tools are only a part of the solution, but they could spark the light. Keep asking and take risks. And don't believe in the models, they may be right!”*

Christian Dupraz

## 1. Optimal design and management: what to think about and how to get there?

If a practitioner decides to implement an AFS there are some issues he has to take into account before starting.

### 1.1 Goal of the AFS

First of all the farmer has to be clear about the goal of the whole system. Should the system provide a new product like timber, should it reduce erosion or increase biodiversity or is the main driver a combination of different objectives. According to these considerations some systems are more appropriate than others.

## 1.2 Framework

In addition to the goals there is a general framework the whole system will be embedded. This includes for example the site, the local climate, market conditions but also laws and legal issues that influence the choice of system and therefore the whole planning. Beside these more external factors there is also a number of internal conditions framing the planning and management (skills of the farmer, machinery, availability of labour, etc.).

## 2. The general concept of supportive tools for AFS

In general, when we talk about “tools” in the context of this MP, we talk about any model, instrument or guideline which can provide support in decision making and planning processes for AFS implementation. An individual tool or a combination of tools hence should enable us to take all the above mentioned framework conditions into account. In addition, some tools grant access to important background information (such as data about climate, soil, tree-crop/animal interaction, traditional knowledge, etc.)

„Tools” can hence be broadly seen as:

- guidelines, books, brochures comprising instructions and suggestions for design and management as well as knowledge on methods and procedures
- computer applications and online tools that facilitate decision making and initial design
- video tutorials
- databases of experts, advisors, consultants on agroforestry systems
- research results
- trainings & courses
- consulting services for farmers by a network of consultants (alternatively: tran staff of existing network) with a common policy and working method, diversity according to local knowledge and field of expertise
- laws and legislative regulations influencing the design and management
- technical books or even technical specifications
- Examples and good practices

Tools being embedded in existing knowledge also means that they provide help in finding relevant information in the right place, and making use of it in the easiest possible way.

### AFS as Dynamic Systems

The design of AFS is based on a series of considerations and (local) conditions, and it is “dynamic”, meaning nothing is fixed. Therefore, since AF is always a long term project, the management needs to be reevaluated from time to time and sometimes adjusted, depending on changes in conditions and needs.

One way to handle this is to structure information and knowledge in a way that the method/technology itself “contains” the system approach element. The other way is some kind of education or shaping of attitudes (which, however, might be beyond the scope of our actions)

Multicropping systems like AFS are more complex, therefore less predictable. Preparation for special events (eg. extreme weather, pests & diseases) new goals, new concepts, new circumstances (environmental and economic) require a flexible planning and installation process, embedded in ecological, local and traditional knowledge. The design should include different options to further develop the system according to a range of actual goals.

## 3. From decision making to planting - concept of tools

There are (at least) three phases a farmer has to go through when introducing AFS into his or her farming system, i.e. decision making, planning and installation of the system. The idea of the tools is to provide farmers with all kind of information, built on different, interacting modules to support decision making and help to choose the type of agroforestry to be adopted.



### 3.1 General information

#### Assessment questionnaire

In a first step a questionnaire is aiming to gather all the important framework conditions for the new AFS. Farmers answer to predefined questions, thus providing information on properties on the farm where agroforestry is to be designed, their goals, further plans, soil properties etc. According to input information and based on existing knowledge on the field, the system offers relevant options and assists in making adequate choices. (Eg. Input main method of farming, followed by objectives of the farmer (fruit, timber, ...?), followed by will of changing machinery, working method etc.)

##### *Example 1:*

Farmer1 wants to keep the way of intensive, mechanized farming, though introducing woody vegetation for any reason (ie: product differentiation, environmental consciousness, preventing erosion, etc) optimize for a minimum in new technologies, need for special expertise and manpower, no big changes in machinery

##### *Example 2:*

Farmer 2 wants to switch to a completely new method of production (ie.: convert to high nature value farming, ecofarming, high biodiversity forest farming, etc.) new methods, need for expertise and trained manpower, business plan critical point

#### Checklist

Using checklists on predefined stage(s) of the decision making process to make sure all important questions are answered and important issues considered. Farmers should follow these step by step and in the right order.

#### Recommendations

The output of the pre-planning/decision making process would be to have a first idea on what kind of AF system is to be considered as suitable for specific situation and goals. At this point, the farmer has an idea, what kind of AF system might be ideal in his/her case.

#### Supplementary information:

Access to information (databases of practices, examples, existing knowledge on main methods of introducing AF etc) is crucial (possibly a database/ network of expert-consultants as well) at this point. (Eg. Financial assessment, feasibility in a preliminary stage - business plan, planning with alternative income sources, plants/animals in the design that could generate income in the first years etc.) MP6

At the end of this step all the important general framework conditions influencing the establishment of an AFS are gathered.

### 3.2 Specific information

Beside the general information described in 3.1 farm-specific and local information are indispensable. The starting point of this phase is a previously defined type of agroforestry (eg. rows of trees in an arable farmland).

In this phase support tools would need specific input, such as: case-specific information (cultivated/raised crops/animals, product use and processing) and local and specific background information (microclimate, soil properties, marketing possibilities, etc.). Several type of tools are possible, for example blocks of description/instructions or consulting service for individual assessment.

At the end of this step, the farmer has a plan and a design of the specific AF project he/she is about to realize on the farm.

### 3.3 Installation

Specific, practical knowledge on the installation of the system organized in a way easily useable for farmers. This part is the „heart“ of the system: knowledge and information structured in a way that it becomes an immediate help for the actual work on the field.

- Modules of practical knowledge (detailed instructions for each steps of the realization)
- Consulting service /training /demonstration of practicess and procedures on the spot

Here the main challenge is organize existing knowledge in an easy-to-use way. The structure of each module could follow the steps of specific parts of the installation project of a specific type of agroforestry; the content would come in the form of instructions and descriptions set up by experts of the field.

As the „final output“ of the tool the farmer is able to realise his/her specific project on the field.

### 3.4 Being practical: Example 1

#### The right tool at the right moment. An example from the „Agroforestry in Flanders“ project (Bert Reubens)

The objective of the Belgian project „Agroforestry in Flanders“, of which a short English summary is to be found [here](#), is to create a breakthrough in a relatively short time of feasible, profitable and effective agroforestry systems in Flanders.

In the framework of this project, not only research activities take place, but a lot of attention goes to practical guidance of farmers engaging in agroforestry. This happens in different ways, such as a personal on-farm advisory system for individual farmers, but also through providing information and guidelines via an online knowledge platform (in Dutch: „[kennisloket](#)“). This knowledge platform, which is to be considered as a continuous „work in progress“ is currently organised as a set of files, topic-wise archived under different categories such as: what is agroforestry about?, establishment, management, introduction of and protection against animals, tree-specific information (all under „[practical approach](#)“), regulations, subsidy opportunities, economics, added value, and research results.

Continuously, new files are being added. In the future, the idea is to organise all this in a more chronological order, allowing users to follow a stepwise approach. Farmers can be at different phases of their agroforestry implementation, such as:

- „You are in the phase of thinking whether AF could be something for your farm“
- „You have taken the decision to implement AF and you are in the phase of planning/design/making choices“
- „You have established your AF system and you are in the phase of managing it“

For every phase, users should be able to follow a kind of checklist and will have the opportunity to go in depth as much as they like, following links to more in-depth information, other tools, etc.

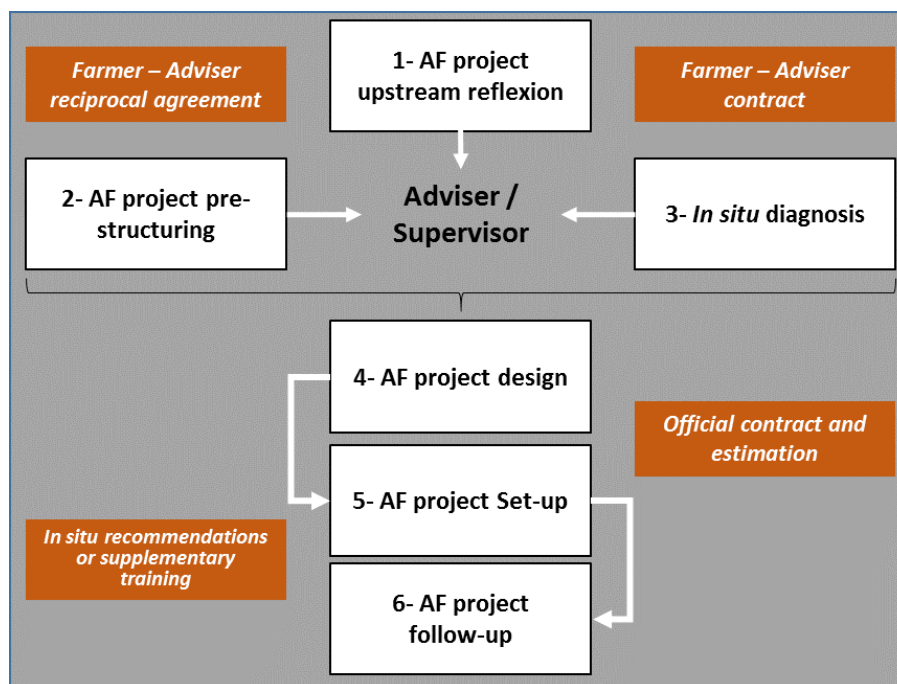
### 3.5 Being practical: Example 2

#### The AF project „TIMELAPSE“ (David Grandgirard)

Agroforestry is quite new for farmers. It is even *strange* for them as they contributed for decades to hedges clearance partly in response to mechanisation as well as for administrative and economic reasons; the reintroduction of trees as a single matrix or as a production mean is most of the case unusual for them. Therefore, when thinking to adopt AF, farmers and other project initiators have progressively to rediscover

every single components of an AF system and challenges it could address. They have to remember why and how tree could be useful to their farm or even for them.

For that, we have compiled evidences and experiences from different experienced experts accompanying farmers or land owners towards the set-up of AF systems. The main goal was to identify and organized the different steps a project initiator has to realise to finally set-up and follow-up an AF project. If steps are numerous (around 60 steps were identified), a very simplified view of the main moment of an AF history are presented in figure 2. All these steps correspond to an AF project time-lapse.



**Figure 1: A very simple view of the successive steps towards the set-up and the follow-up of an agroforestry project (AF project) along time (Sources: Marin, Liagre & Grandgirard, RMT Agroforesteries, 2014-16)**

### 3.6 Being practical: Example 3

#### The AF T&R needs evolution along time (David Grandgirard)

For the same reasons, famers or AF initiators see their individual needs concerning agroforestry Tools & Resources (AF T&R) evolve along the process of deciding if AF is a real opportunity, is adapted to their farm/parcel characteristics and is meeting the expected economic or social valuation they're targeting. This AF T&R needs evolution has been explored during the French 2014-17 Agroforestry RMT project together with 29 AF project initiators (Figure 1). Primary results showed that, according to the age of the farmer reflection, AF T&R needs change progressively from : 1- needs concern networking and identification tools, economic or again technical tree references to judge of the realism and of the feasibility of AF, 2- then, needs concern AF project design and management technics when the AF project has been recently setup, towards 3- needs concerning the will to exchange with other AF farmers by visiting demonstration sites, confronting experiences in order to start to understand and assess the performances of their own AF system.

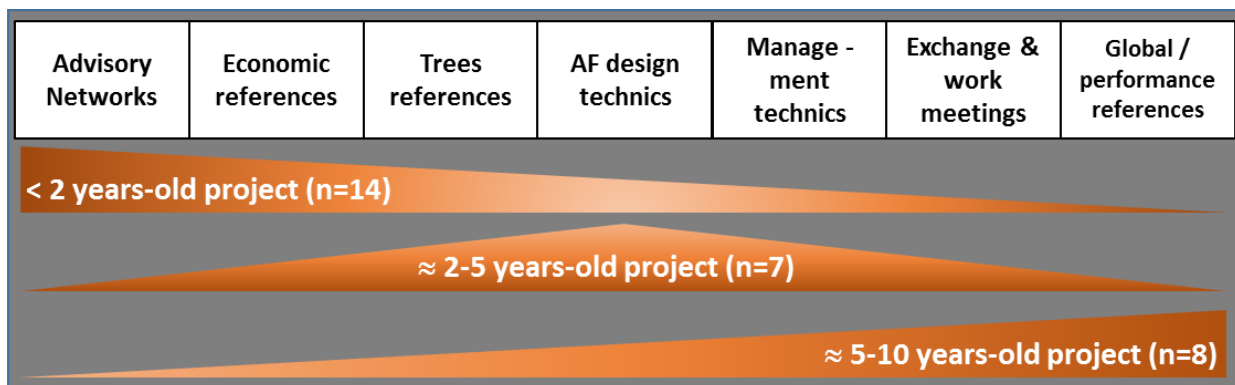


Figure 2 : Progressive evolution of the AF T&R needs for a AF project initiator (Sources : Falampin & Grandgirard, RMT AgroforesterieS, 2014-16)

As explained previously, for every AF project initiator, to be able to find the good references and answers at the good moment is crucial as doubt and the absence of references are by far the first reasons for which farmers decide to drop out or have set-up an non-realistic AF system. To be “helped” individually all along the AF project time-lapse (see figure 0), agroforestry-dedicated T&R have to be censed and provided through a single transparent and open web platform where to make a well informed choice. We effectively assume that diversity of T&R would be large and competitive enough in the next decade that AF project initiator would need help to save time and avoid lack of clarity risks.

This type of applied web platforms is emerging and is very often used by “technicians or experts” of one given subject. We can for instance list the [GlobAllomeTree platform](#) a simple platform censeng where to find the best model to assess the potential growth of your AF trees on your parcel, or again the [PLAGE platform](#) where to decide of the most relevant Indicator-based assessment tool to judge of the agro-environmental performances of your cropping system.

This example is promising as it proposes to decide of the finality of the assessment (references acquisition, simulation of the set-up of innovative practices, administrative audit preparation, etc.) and of the conditions of usage the user can envisage with. For that, a ID form for every single tool has to be provided before to be audited and registered within the platform; this tool ID presents elements such as the tool conditions of usage, its assessment limits and validity, the targeted users, the details of the training session dedicated to the obtaining and use of the tool, etc. It also includes tool characteristics such as the “targeted crops or cropping system”, the central “challenge to be address”, the “spatial and temporal scales” at which to obtain results, the “finality of the assessment” ... or again the “tool training session duration”.

| Critère   | Modalité   | XPERT         | CASSIOPÉE   | DIAPHYT | SYSTERRE | CAPZER   | CAPZER   |
|---|--|---------------|-------------|---------|----------|----------|----------|
|   |  | ENVIRONNEMENT | PERFORMANCE |         |          | NIVEAU 1 | NIVEAU 2 |
| Production(s) dominante(s)  | Arboriculture                                    |               |             |         |          |          |          |
| Enjeu   | Technique / agronomique                          |               |             |         |          |          |          |
| Enjeu > ... > Air   | Emission de GES                                  |               |             |         |          |          |          |
| Enjeu > ... > Biodiversité  | Contribution à la biodiversité domestique        |               |             |         |          |          |          |
| Echelle spatiale de saisie des données                              | Parcelle ou groupe de parcelle                   |               |             |         |          |          |          |
| Echelle temporelle de saisie des données                            | Année culturale                                  |               |             |         |          |          |          |
| Echelle spatiale de restitution des indicateurs                     | Atelier de production                            |               |             |         |          |          |          |
| Echelle temporelle de restitution des données                       | Année culturale                                  |               |             |         |          |          |          |
| Finalité de l'évaluation  | Suivre les pratiques agricoles (tableau de bord) |               |             |         |          |          |          |
| Durée de prise en main de l'outil (y compris le temps de formation) | Moyenne (<= 1 jour)                              |               |             |         |          |          |          |
| NOTE  |  | 8/10          | 7/10        | 7/10    | 7/10     | 6/10     | 6/10     |

Figure 3: Example of results obtained from the tools ranking process within the RMT ERYTAGE – PLAGE Evaluation web platform

By specifying these characteristics, the user is progressively fine-tuning its needs and is obtaining in response the ranking of the different tools censused and described within the web platform. Finally, without any commercial influence, he can choose among the most appropriate tools by referring to the ranking obtained. In our example, *Xpert Environnement* or *Cassiopee performance* would fit best to our expectations.

To dispose of the same kind of platform, AF actors over Europe have to enumerate and describe (respecting a T&R ID form) all AF-dedicated tools and resources already existing, but they also have to confirm that every AF-dedicated T&R is performing well and based on up-to-date references. So that, the advent of an AF web platform would have to be accompanied by the emergence of an experts' group enable to evaluate of the relevance of the AF T&R.

In this framework, during the preparation of this MP, we have started to list some of the tools and resources actually used (see annex 1) in order to illustrate the dynamics that could be of primary importance for every one of the agroforestry actors. Please be aware that this is a non-exhaustive list.



## 4. Conclusion

The existing and missing tools we focus on in this minipaper are largely knowledge-based tools – it can be stated that in the process of promoting agroforestry the main task is to make knowledge available for farmers (including knowledge about the existence of agroforestry systems and their ecological and economic benefits).

There are different diagnosis and design tools existing, so a well planned project should start with censusing national and sometimes international tools and resources which can be useful solutions to the needs of farmers and advisers. Afterwards it would be possible to develop tools and resources according to needs and demands which are not addressed by existing tools. (E.g. a close cooperation between farmers and experts could lead to the development of an assessment questionnaire / decision supporting tool for the very first phase of establishing an agroforestry system.)

Beyond making knowledge available, it is crucial that tools and resources are interconnected within a system in a way that farmers/advisors moving from one step to another can easily reach them. Therefore finding the proper, technically elaborated ways of connections is also an area to focus on. Operational groups – beyond gaining experience in design and installation of AF systems, thus develop on the material (instructions, descriptions) of different modules of practical knowledge - could further develop the idea and structure of tools, and the ways of connecting them with one another.

During the process we must consider the question of who the end-user of these tools would be. Farmers are the primary and foremost user group, but in practice it is often intermediaries such as advisors, consultants, support services, trainers, etc who actually make use of this. So, when discussing tools and resources of AF systems, we also have to consider the challenge of reaching these people, making them aware of tools and guidelines existing, and convincing them of talking with farmers about agroforestry. This problematic probably can be addressed in two ways: one is to create tools that farmers can use by themselves; the other is to work on establishing a network of advisors and/or train advisors who already work with farmers in other projects. Even if this is not the main focus of this MP, we have to keep in mind that the outcome and results of the work on tools and resources depends very much on how advisor-networks could be involved.

## Annex: Inventory of Tools & Guidelines

| Name   | Tool or Guideline <sup>1</sup> | Developed by                                | Weblink (if available)  | Other sources of info | Freely available (Y/N) | Language | Kind of information or support provided   | AF system focused upon (silvoarable, silvopastoral, other) | Status <sup>2</sup> | Widely applicable / region specific | Personal experience (positive)                                | Personal experience (negative)   | Specific info. missing  | Other remarks  |
|--|--------------------------------|---|---|-----------------------|------------------------|----------|---|--|---------------------|-------------------------------------|---|--|---|--|
| BOBO tool  | T                              | INBO  | <a href="http://data.inbo.be/bobo/">http://data.inbo.be/bobo/</a>   |                       | Y                      | Dutch    | Support on tree species selection through evaluation of suitability for specified soil conditions   | any system in which trees are introduced (even forest)     | O                   | Region specific (Flanders)          | Very useful tool - we used it for all individual farm advices | Limited in the list of tree species / does not fully replace a field check since certain conditions (drainage e.g.) are not considered | Certain tree species missing in the database used for this tool   |  |
| Kennisloket agroforestry   | G                              | Consortium Agroforestry Flanders            | <a href="http://www.agroforestryvlaanderen.be/NL/Kennisloket/tabid/9129/language/nl-BE/Default.aspx">http://www.agroforestryvlaanderen.be/NL/Kennisloket/tabid/9129/language/nl-BE/Default.aspx</a>         |                       | Y                      | Dutch    | guidelines and info on tree species, plant material, design and planting, maintenance of trees and vegetation strip, productivity, prices for installation, legislation, subsidies, agronomic-technical considerations, ... | both silvoarable and silvopastoral                         | O / D               | Mostly widely applicable            | Very practical - to the point - organised in sheets per topic |  | Currently no (detailed) info on e.g. marketing possibilities for AF products, expected impact on (animal or plant) diseases / pests | Will be further developed in the coming 2-3 years. All suggestions for topics to be addressed are welcome. |
| Management Guidelines for valuable wood production in Agroforestry systems | G                              | Chair of Forest Growth, University Freiburg | <a href="http://www.agroforestry-uni-freiburg.de/images/pdf/Management_guidelines_for_valuable_wood.pdf">http://www.agroforestry-uni-freiburg.de/images/pdf/Management_guidelines_for_valuable_wood.pdf</a> |                       | Y                      | English  | focus on management of trees, guidelines and short information on tree species, plant material, design and planting, management of trees, ...   | both silvoarable and silvopastoral                         |                     | Mostly widely applicable            |   |  |   |  |
| Wertholzproduktion in Agroforstsystemen - Ein Leitfaden für die Praxis     | G                              | Chair of Forest Growth, University Freiburg | <a href="http://www.agroforestry-uni-freiburg.de/images/pdf/Leitfaden_Wertholzprodukt2.pdf">http://www.agroforestry-uni-freiburg.de/images/pdf/Leitfaden_Wertholzprodukt2.pdf</a>                           |                       | Y                      | German   | focus on management of trees, guidelines and short information on tree species, plant material, design and planting, management of trees, ...   | both silvoarable and silvopastoral                         |                     | Mostly widely applicable            |   |  |   |  |
| Moderne Agroforstsysteme mit Werthölzern - Leitfaden für die Praxis        | G                              | Chair of Forest Growth, University Freiburg | <a href="http://www.agroforestry-uni-freiburg.de/images/pdf/agroforstsysteme.pdf">http://www.agroforestry-uni-freiburg.de/images/pdf/agroforstsysteme.pdf</a>   |                       | Y                      | German   | some general information about agroforestry and its advantages and disadvantages, guidelines and short information on tree species, plant material, design and planting, management of trees, ...                           | both silvoarable and silvopastoral                         |                     | Mostly widely applicable            |   |  |   |  |

<sup>1</sup> Tool (dynamic, allowing personal input/choices) or Guideline (only descriptive)

<sup>2</sup> Status (D=still under development, O=operational, N=not operational anymore)

| Name   | Tool or Guideline <sup>3</sup> | Developed by                    | Weblink (if available)  | Other sources of info   | Freely available (Y/N)     | Language | Kind of information or support provided   | AF system focused upon (silvoarable, silvopastoral, other)                   | Status <sup>4</sup> | Widely applicable / region specific                       | Personal experience (positive)  | Personal experience (negative)   | Specific info. missing  | Other remarks  |
|--|--------------------------------|---------------------------------|---|---|----------------------------|----------|---|--|---------------------|---|---|--|---|--|
| ESC-DSS (ecological site classification decision support system) | T                              | UK Forestry Commission          | <a href="http://www.forestry.gov.uk/esc">http://www.forestry.gov.uk/esc</a>   | on the website  | Yes after registration     | English  | a PC-based system to help guide forest managers and planners to select ecologically suited species to sites   | any system in which trees are introduced (in fact developed for forestry)    | O                   |   | no experience yet   | no experience yet  |   |  |
| FarmsAFe   | T                              | sAFe FP6 program                | <a href="https://www.agforward.eu/index.php/fr/1683.html">https://www.agforward.eu/index.php/fr/1683.html</a>                             | <a href="http://www.agroforesterie.fr/CASDAR/20062008/rapports0608/R12.pdf">http://www.agroforesterie.fr/CASDAR/20062008/rapports0608/R12.pdf</a>   | Y (but simplified version) | French   | Excel-based calculator to estimate the ROI of an imagined/real AF system to be set-up or already existing   | both silvoarable and silvopastoral   | O                   | Mostly widely applicable                                  | I'm just discovering it - should be ok                                | a bit complex to manipulate  | senbility/robustness assessment of the tool (have to be made locally by yourself when disposing of reference datas) | Hope a training session from the developpers             |
| YieldsAFe  | T                              | sAFe FP6 program                | <a href="https://www.agforward.eu/index.php/fr/1683.html">https://www.agforward.eu/index.php/fr/1683.html</a>                             | <a href="https://www.agforward.eu/index.php/fr/yield-safe-model-improvements.html">https://www.agforward.eu/index.php/fr/yield-safe-model-improvements.html</a> , <a href="http://www.sciencedirect.com/science/article/pii/S092585740600231X">http://www.sciencedirect.com/science/article/pii/S092585740600231X</a> | Y (but simplified version) | English  | The ultimate goal of the Yield-SAFE model is to predict dynamically site-specific long-term tree and crop yields under competitive conditions on the basis of historical or generated weather data, i.e. solar radiation, temperature and precipitation and relevant soil physical characteristics.             | silvoarable  | O/D                 | Mostly widely applicable                                  | none  | none   | not for farmers and advisers / researchers rather   |  |
| LER-sAFe   | T                              | sAFe FP6 program                |   | <a href="http://www.agrooof.net/agrooof_dev/documents/safe/Economic_silvoarable_systems_LER_approach.pdf">http://www.agrooof.net/agrooof_dev/documents/safe/Economic_silvoarable_systems_LER_approach.pdf</a>   | Y/N                        | French   | I saw it used, within FramAFe but I never performed to obtain it!!!   | silvoarable  | O/D                 | Mostly widely applicable                                  | none  | none   |   |  |
| HisAFe   | T                              | sAFe FP6 program                | <a href="http://copsis.cirad.fr/copsis/media/couplage_hisafe_stics.pdf">http://copsis.cirad.fr/copsis/media/couplage_hisafe_stics.pdf</a> | contact Christian DUPRAZ  | N                          | English  | Scientific tool, very complex enable to simulate light, soil and water used in 3D AF systems and to predict trees growth and crop yields - you have to follow a INRA training on 3days to use it  | silvoarable  | D/O                 | Mostly widely applicable                                  | none  | none   | not for farmers and advisers / researchers rather   | Training session from the developpers of INRA UMR SYSTEM |
| Can_Vis  | T                              | USDA / NOAA                     | <a href="https://coast.noaa.gov/digitalcoast/tools/canvis">https://coast.noaa.gov/digitalcoast/tools/canvis</a>                           | on the website  | Y                          | English  | easy-to-use, downloadable visualization tool allows users to "see" potential changes in a landscape, farm, parcel based-on additional landscape element onto actual pictures a  | all  | O                   | Widely applicable   | Very useful tool - can be used from 2D or 3D perception of AF systems | none   | can be asked directly to USDA or NOAA   | none   |
| TBS Grid   | T                              | UniLaSalle - Agrooof - AFAC ... | none actually   | to be published   | Y                          | French   | Sorting/evaluating every single tree within a SAF system in order to choose those kept for wood production, those for firewood production and those eliminated during the first 15 years of the system - you need to have x time the final density of your SAF - a kind of "selection tools of promising trees" | all but not Hedgerow/hedges system - only 10 tree specie considered actually | D-O (test stesp)    | Mostly widely applicable - through tree species may be !? | Useful and quit representative  | even if a bit long (>20 criteria to be assessed for each tree = 10 minutes/tree) | Should be published by end of 2017 and made available by beginning of 2018  | I'm supervising it                                       |

<sup>3</sup> Tool (dynamic, allowing personal input/choices) or Guideline (only descriptive)

<sup>4</sup> Status (D=still under development, O=operational, N=not operational anymore)

| Name       | Tool or Guideline <sup>5</sup> | Developed by          | Weblink (if available)  | Other sources of info   | Freely available (Y/N) | Language         | Kind of information or support provided  | AF system focused upon (silvoarable, silvopastoral, other) | Status <sup>6</sup> | Widely applicable / region specific | Personal experience (positive)                                | Personal experience (negative)                                  | Specific info. missing      | Other remarks  |
|------------|--------------------------------|-----------------------|---|---|------------------------|------------------|--|--|---------------------|-------------------------------------|---|---|-----------------------------|--|
| PAGESA     | G                              |                       | <a href="http://www.agroforesterie.fr/PAGESA.pdf">http://www.agroforesterie.fr/PAGESA.pdf</a>   | <a href="http://www.agroforesterie.fr/images-pages/revue/revue_3_extra_t_3.pdf">http://www.agroforesterie.fr/images-pages/revue/revue_3_extra_t_3.pdf</a> | Y                      | French           | Technical guideline onto the AF systems set-up and management  | all  | O                   | Widely applicable                   | complete even if basic sometimes                              | could need auxiliary tools                                      |                             | 2009 version ... so should be updated                        |
| Cahier DVD | G                              | SCOP Agroof           | <a href="http://www.agroof.net/agroof_edition/cahierDVD01.html">http://www.agroof.net/agroof_edition/cahierDVD01.html</a>   |   | N (32€)                | French           | Everything with video (DVD) onto selection of tree species and SAF design, SAF preparation and installation, and on SAF trees pruning                                | all  | O                   | Mostly widely applicable            | Very good and helpful for beginners or even for young adviser | no  | SAF design is not developed | really perfect to progress and understandable by farmers too |
| PIRINOBLE  | G                              | IDF                   | <a href="http://www.pirinoble.eu/fr/index.htm">http://www.pirinoble.eu/fr/index.htm</a>   | <a href="http://www.pirinoble.eu/fr/publi.htm">http://www.pirinoble.eu/fr/publi.htm</a>   | Y                      | French           | technical guides to sort and chose tree species according to ecological conditions   | all  | O                   | Mostly widely applicable            | easy to use   | a 1st basis before to check complementary information           |                             |  |
| PIRINOBLE  | G                              | IDF                   | <a href="http://www.pirinoble.eu/fr/index.htm">http://www.pirinoble.eu/fr/index.htm</a>   | <a href="http://www.pirinoble.eu/fr/publi.htm">http://www.pirinoble.eu/fr/publi.htm</a>   | Y                      | French           | technical guides to decide protection technics and materials for trees   | all  | O                   | Mostly widely applicable            | easy to use   | a 1st basis before to check complementary information           |                             |  |
| Guide APCA | G                              | APCA                  | <a href="http://www.agroof.net/agroof_ressources/documents/guide_juridique_apca_juin2010.pdf">http://www.agroof.net/agroof_ressources/documents/guide_juridique_apca_juin2010.pdf</a> |   | Y                      | French           | Juridical guideline to implement AF system within agricultural parcel  | both silvoarable and silvopastoral                         | O                   | National (FR) scale only            | easy to use   | a 1st basis before to check local/actual juridical information  |                             | 2010 version / to be updated (to be published)               |
| ECOFLORE   | T                              | Bartolli et al., 2000 | <a href="http://documents.ircvues.inist.fr/handle/2042/5386">http://documents.ircvues.inist.fr/handle/2042/5386</a>   | <a href="http://agris.fao.org/agris-search/search.do?recordID=FR2001004062">http://agris.fao.org/agris-search/search.do?recordID=FR2001004062</a>         | Y?                     | French / English | To conduct the ecological diagnosis o closed-forestry-quadrats in order to determine which AF tree species can be implanted in the neighbouring agricultural parcels | both silvoarable and silvopastoral                         | O                   | National (FR) scale only            | none  | none  |                             | The tool has to be claimed to the authors                    |
| PCET       | G                              | ADEME                 | <a href="http://www.ademe.fr/agroforesterie-outil-carbone-pcet">http://www.ademe.fr/agroforesterie-outil-carbone-pcet</a>   |   | Y                      | French           | Technical guideline and case studies to envisage AF as a Carbon-sink   | both silvoarable and silvopastoral                         | O                   | National (FR) scale only            | none  | none  |                             | 3 other documents joined to it                               |
| COMET-Farm | T (web)                        | USDA - Colorado state | <a href="http://cometfarm.nrel.colostate.edu/Home">http://cometfarm.nrel.colostate.edu/Home</a>   |   | Y                      | English          | Farm-level GHG calculator with a agroforestry system option  | all  | O                   | National (USA) scale only           | web design and facilities                                     | american references and equations not completely precise for EU |                             | personal codes are needed and obtained easily                |

<sup>5</sup> Tool (dynamic, allowing personal input/choices) or Guideline (only descriptive)

<sup>6</sup> Status (D=still under development, O=operational, N=not operational anymore)



| Name                        | Tool or Guideline <sup>7</sup> | Developed by          | Weblink (if available)  | Other sources of info   | Freely available (Y/N) | Language | Kind of information or support provided   | AF system focused upon (silvoarable, silvopastoral, other) | Status <sup>8</sup> | Widely applicable / region specific   | Personal experience (positive)            | Personal experience (negative)   | Specific info. missing | Other remarks  |
|-----------------------------|--------------------------------|-----------------------|---|---|------------------------|----------|---|--|---------------------|---|---|--|------------------------|--|
| GEF GHG calculator          | T                              | IFEU                  | <a href="http://www.qwp.org/Global/ToolBox/References/Global%20Assessments%20and%20Guidelines%20for%20Sustainable%20Liquid%20Biofuel%20Production%20in%20Developing%20Countries%20-%20Screening%20Toolkit-%20GUIDELINES%20FOR%20DECISION%20MAKERS%20(GEF,%20FAO,%202013).pdf">http://www.qwp.org/Global/ToolBox/References/Global%20Assessments%20and%20Guidelines%20for%20Sustainable%20Liquid%20Biofuel%20Production%20in%20Developing%20Countries%20-%20Screening%20Toolkit-%20GUIDELINES%20FOR%20DECISION%20MAKERS%20(GEF,%20FAO,%202013).pdf</a> | IFEU – Institute for Energy and Environmental Research Heidelberg GmbH  | Y                      | English  | Liquid biofuel GHG balance from most of the agricultural raw material (from wood as a part of)  | all  | O                   | region specific (regarding the references used within the models and equations) | none                                      | none   |                        | Difficult to find back the excel calculator, I have a copy if needed   |
| TRAITAUT                    | G                              | GIP ECOHOR            | <a href="http://www.gip-ecofor.org/doc/drupal/Autecologie_outils_Traitaut_020513.pdf">http://www.gip-ecofor.org/doc/drupal/Autecologie_outils_Traitaut_020513.pdf</a>   | <a href="http://www.gip-ecofor.org/web/?q=node/923">http://www.gip-ecofor.org/web/?q=node/923</a>                                   | Y                      | French   | census of the decision support system using tree species (aut-)ecology and biology  | all  | O                   | Widely applicable   | none                                      | none   |                        |  |
| AFFOREST                    | T                              | Gilliams et al., 2004 | <a href="http://www.forestdss.org/wiki/index.php?title=AFFOREST-sDSS">http://www.forestdss.org/wiki/index.php?title=AFFOREST-sDSS</a>   | <a href="http://link.springer.com/article/10.1007/s11056-004-0761-z">http://link.springer.com/article/10.1007/s11056-004-0761-z</a> | ?                      | English  | decision support system using tree species (aut-)ecology and biology to the (re)forestation of agricultural land  | all  | O                   | Widely applicable   | none                                      | none   |                        | 0  |
| APIL                        | T                              | M. Bounab CA Ariège   | none actually   |   | Y?                     | French   | Economic calculator to estimate the net present value or the ROI of a AF system   | all  | O                   | Widely applicable   | simple (too?)                             | none   |                        | The tool is really basic, to help farmer and adviser to "imagine" accountancy of the AF system they are building |
| Globalallometree            | T                              |                       | <a href="http://www.globalallometree.org/">http://www.globalallometree.org/</a>   |   | Y                      | English  | GlobAllomeTree was the first international web platform to share and provide access to tree allometric equations, created in 2013. Since then wood densities, biomass expansion factors, and raw data have been added to the platform | all  | O                   | Widely applicable   | very simple and free, complete            | none actually or may be the complexity to provide allometric knowledges within the webplatform |                        | for researchers ??   |
| Annuaire des conseillers AF | T                              | AFAF                  | <a href="http://www.agroforesterie.fr/agroforesterie-annuaire-base-structures-operateurs-conseil-technique-projet-agroforestier.php">http://www.agroforesterie.fr/agroforesterie-annuaire-base-structures-operateurs-conseil-technique-projet-agroforestier.php</a>   |   | Y                      | French   | map of the different AF advisers or advisory actors sorted by geographic places then by individual specificities  | all  | O                   | National (FR) scale only  | very simple, sometimes not complete/exact | individual ID information could be erroneous   |                        | other maps exist   |
| Plantagro                   | T                              | CIFOR                 | <a href="http://www.cifor.org/library/331/mobilizing-expert-knowledge-of-tree-growth-with-the-plantagro-and-infer-systems/">http://www.cifor.org/library/331/mobilizing-expert-knowledge-of-tree-growth-with-the-plantagro-and-infer-systems/</a>   | PLANTAGRO - Plantation and Agroforestry Species Selection Tool  | ?                      | English  | Model giving estimation of the development and growth of trees regarding environmental and local characteristics - allow for the creation of forestry scenarios using variable soil, climate and tree species information             | all  | ?                   | ?   | ?   | ?  | ?                      | ?  |

<sup>7</sup> Tool (dynamic, allowing personal input/choices) or Guideline (only descriptive)

<sup>8</sup> Status (D=still under development, O=operational, N=not operational anymore)



|   |   |       |   |  |   |         |                                      |     |   |                 |   |   |   |   |
|---|---|-------|---|--|---|---------|--------------------------------------|-----|---|-----------------|---|---|---|---|
| <b>Agroforestry database</b>            | T | ICRAF | <a href="http://www.worldagroforestry.org/output/agroforestry-database">http://www.worldagroforestry.org/output/agroforestry-database</a>   |  | Y | English | a tree reference and selection guide | all | O | Region specific | ? | ? | ? | ? |
| <b>Agroforestry Species Switchboard</b> | T | ICRAF | <a href="http://www.worldagroforestry.org/products/switchboard/index.php/name_like/Acacia/">http://www.worldagroforestry.org/products/switchboard/index.php/name_like/Acacia/</a> |  | Y | English |                                      | all | O | Region specific | ? | ? | ? | ? |