UNISECO

UNDERSTANDING & IMPROVING THE SUSTAINABILITY OF AGRO-ECOLOGICAL FARMING SYSTEMS IN THE EU

Deliverable Report D6.1: Report on the Prototype of the Spatially Explicit Interactive Online Tool and Functions

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ACRONYMS

AEFS	Agro-ecological Farming Systems
API	Application programming interface
CAP	Common Agricultural Policy
EC	European Commission
EU	European Union
ESRI	Environmental Systems Research Institute
FAO	Food and Agriculture Organization of the United Nations
GDPR	General Data Protection Regulation
GHG	Greenhouse gas
GIS	Geographical information system
GLOBIL	Global Observation and Information Portal
GUI	Graphical user interface
IPCC	Intergovernmental Panel on Climate Change
M	Month
MA	Multi-actor
MAP	Multi-Actor Platform
MS	Milestone
NGO	Non-Governmental Organisation
NUTS	Nomenclature of Territorial Units for Statistics
PAG	Project Advisory Group
RDP	Rural development programme
SDGs	Sustainable Development Goals
SES	Socio-ecological system
SESSIT	Socio-ecological system interaction tool
SRG	Stakeholder Reference Group
UN	United Nations
WP	Work package

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EXECUTIVE SUMMARY

This Deliverable outlines a prototype of a spatially explicit interactive online tool (Deliverable D6.3) and outlines the objectives for the development of a methodological handbook on transdisciplinary sustainability assessment (Deliverable D6.4). The document provides an outline of the technical elements for the tool, based upon the web app development environment of Esri (Story Maps). These elements include the graphical user interface (GUI) and server side data management, and a set of variables to be implemented, derived from the description of Socio-Ecological Systems which describe the different dimensions of sustainability. These specifications lay the foundation for building a prototype version of the tool, the development and content of which continues until release of the tool (D6.3, Month 35).

The overall purpose of the tool is to increase understanding of the sustainability of agriculture, and in particular the role that agro-ecological transitions can play in increasing sustainability of European agriculture. For this purpose the tool provides a channel for delivering and viewing information as an effective means of communication between actors involved in such transitions. The plans for development of the tools are to implement it on a platform which requires minimal technical knowledge for easy content creation at a local level, for example by other projects or farmers who want to share information on more sustainable practices in agriculture.

The tool is based upon the use of maps of different aspects of sustainability of farming systems, available at different spatial resolutions. Maps provide interactive visual representations of the geography of an area (Tomlinson, 2013), to which stories of farmers and other value chain actors who aspire more sustainable solutions for food production can be associated. Maps also provide an output format for the communication of results of spatially distributed Decision Support Tools which can support illustrations of why some solutions work, and their limitations.

The tool will include indicators of social, economic and environmental dimensions of sustainability. The qualitative data collected will be used in stories developed about the project case studies, and quantitative data will be presented as maps created from statistical data and model outputs.

The concept of the tool was discussed in workshops with stakeholders and members of the EU Multi-Actor Platform. Their feedback has informed the development of plans for the tool, including the inclusion of indicators such as biodiversity and pesticide use, which would be important considerations when communicating information on sustainability of agro-ecological farming. Other items highlighted in the feedback included the benefits of using audio-visual video material as part of stories of agro-ecological farms. It is proposed that the tool will be managed by a key stakeholder (WWF) to enable knowledge sharing after the completion of the UNISECO project.

The main purpose of the methodological handbook is to offer scientists and practitioners guidelines when planning and carrying out agro-ecological approaches for enhancing sustainability in co-construction settings. The handbook is developed around a logic model of the process of assessing sustainability for enhancing agro-ecological transitions in co-construction settings. This builds on the experiences with logic model based handbooks of the ENVIEVAL project that were adopted in the guidelines for the assessment of RDP achievements and impacts in 2019 developed by the European Evaluation Helpdesk for Rural Development (European Evaluation Helpdesk for Rural Development, 2018). The handbook will function as a methodological framework, guiding scientists and practitioners through the co-construction and assessment of agro-ecological transitions. It will suggest different routes depending upon factors such as the type of farming system and agro-ecological practices, socio-cultural context and experiences of actors, data availability or different sustainability challenges to be addressed by the intended transition. The step-by-step flow of the logic model(s) will help in the design of a consistent transdisciplinary assessment workflow.

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1. INTRODUCTION

This Deliverable outlines the prototype of the spatially explicit interactive online tool of UNISECO (Deliverable D6.3) and outlines objectives for the development of a methodical handbook for transdisciplinary sustainability assessment (UNISECO Deliverable D6.4.)

Design of the tool involves synthesising project outputs to spatially explicit information, where appropriate, on the sustainability of agriculture, taking account of both the technical limitations and stakeholder needs. The tool will be integrated into the agro-ecological knowledge hub (AKH) and cross-reference the methodological handbook. The description of the tool includes story maps, which are one of the main channels of communication from the UNISECO project.

This document presents a technical specification for the tool including the graphical user interface (GUI) and server side data management plan. It also presents a set of variables, derived from the description of the Socio-ecological System in Work Package 2, which are the most relevant for describing the different dimensions of sustainability in the UNISECO case studies, and which can be implemented in the tool.

With respect to the tool, this document sets out its:

i) purpose, aims and objectives;
ii) the concept, structure and functions;
iii) integration of outputs from Work Packages 3 to 5;
iv) integration into the agro-ecological knowledge hub;
v) intended impacts .

It also sets out the objectives for the methodological handbook.

The sections which follow set out the foundations for building a prototype version of the tool. The technical specifications and contents of the tool will continue to be developed until its release in March 2021 (Deliverable D.6.3, Month 35). The handbook will also be completed in March 2021 (Deliverable D.6.4, Month 35).

2. TOOL CONCEPT

The purpose of the UNISECO project, and the concept of the online tool, is to provide information that facilitates increasing the sustainability of agriculture. The project sets out to strengthen the sustainability of European farming systems. In achieving this objective it faces the challenge of how to understand complicated social and ecological interactions. To do so, it adopts an approach popularised by Elinor Ostrom (2011), i.e. considering the sustainability of resource management, or lack of it, as a system.

Socio-Ecological Systems (SES) are formed by complex interactions between groups of people and their environment. When considering a particular sub-system, such as farming systems in the case of the UNISECO project, it can be difficult to draw conclusions on the sustainability of some practices from the perspective of multiple actors and multiple resources involved. To address this challenge, the work of Ostrom (2011) suggests that the key decision makers involved in the sustainable use of resources are those operating at the local level. Therefore, the results, and the definition of the research questions, should involve local actors.

The UNISECO project involves Multi-Actor Platforms at the local and European Union levels. This is in line with Ostrom's (2011) ideas that higher level regimes (such as the European Union) can facilitate self-organisation of sustainable resource use by providing accurate scientific information, in particular when the

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information is based on interactions with the local resource users. The conclusion is that there should be trust in decisions taken at the local level to promote sustainable agriculture, but ensure that the decisions are based on accurate information. However, the descriptions of the Socio-Ecological Systems are abstractions and too complicated to function as an effective form of communication with the local resource users. Thus, synthesising complex systems to a few key sustainability metrics is a necessary step for the effective communication with local level decision makers. Since transfer of information is more effective when it is not one way, the concept of the spatially explicit tool should include options for interaction between users and the information on sustainability. An example is the demonstration of how different priorities impact on agro-ecological transitions and change agro-ecological practices.

Approaches to the promotion of sustainability by facilitating local self-organisation (adopted from Ostrom 2011) are:

- Use of accurate scientific information (especially if there is good interactions with local actors)
- Use of conflict resolution arenas
- Provision of effective technical assistance (especially if actors are viewed as partners)
- Use of mechanisms to back up efforts for local monitoring and sanctioning

In farming, as in other resource use systems, the local level decisions are often influenced by decisions taken by higher levels of governance such as the European Union. Depending upon the characteristics of the stakeholders of agro-ecological systems, these decisions can be different in nature. For example, a farmer can decide to go to the field to plant a different crop, while a politician can vote for a different policy in parliament. While such decisions can be interlinked, the resolution and spatial coverage of the data needed for truly sustainability increasing decision can be very different. Thus, a single approach for a universal tool would be unlikely to provide information which would be useful at either of the levels of decision making.

The approach used by UNISECO has two elements. i) For farmers, advisors, other value chain actors and consumers, illustrated stories are provided which are enriched with carefully selected infographics which are quick to read and digest. They will contain links to more in-depth analysis from different sustainability perspectives. ii) For a more general level of agro-ecological development and policy, map views are used which summarise regional trends of sustainability indicators. This part of the tool will contain links to the farm level narratives.

In addition to the functionality of the tool as a delivery mechanism for scientific information, its development paves the way for other ways of facilitating local self-organisation, such as conflict resolution, technical assistance and the provision of a mechanism that supports the monitoring and sanctioning of local resource use.

3. TOOL STRUCTURE

Following the concept of “target audience as user” in the rest of the agro-ecological knowledge hub, the tool is organised by the intended target groups for the information and geographic coverage. The audience sections designed for citizens (NGOs, civic organisations, local community), Consumers and the Science and innovation are primarily directed towards narratives (implemented as story maps). By comparison, the audiences of Science and innovation, and European Commission and Authorities and Administration are directed towards larger geographic areas (implemented using a customised web application). However,

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these groupings are not tightly specified. The sustainability themes include links between the stories and the quantitative and spatially explicit approach.

These two aspects of the tool can be accessed from different sections of the agro-ecological knowledge hub. The first entry point is an embedded story map at https://uniseco-project.eu/, which will be replaced under the root domain of the agro-ecological hub. This map has three tabs associated with it. These control what is displayed in the map as well as what happens when points of interests on the map are activated.

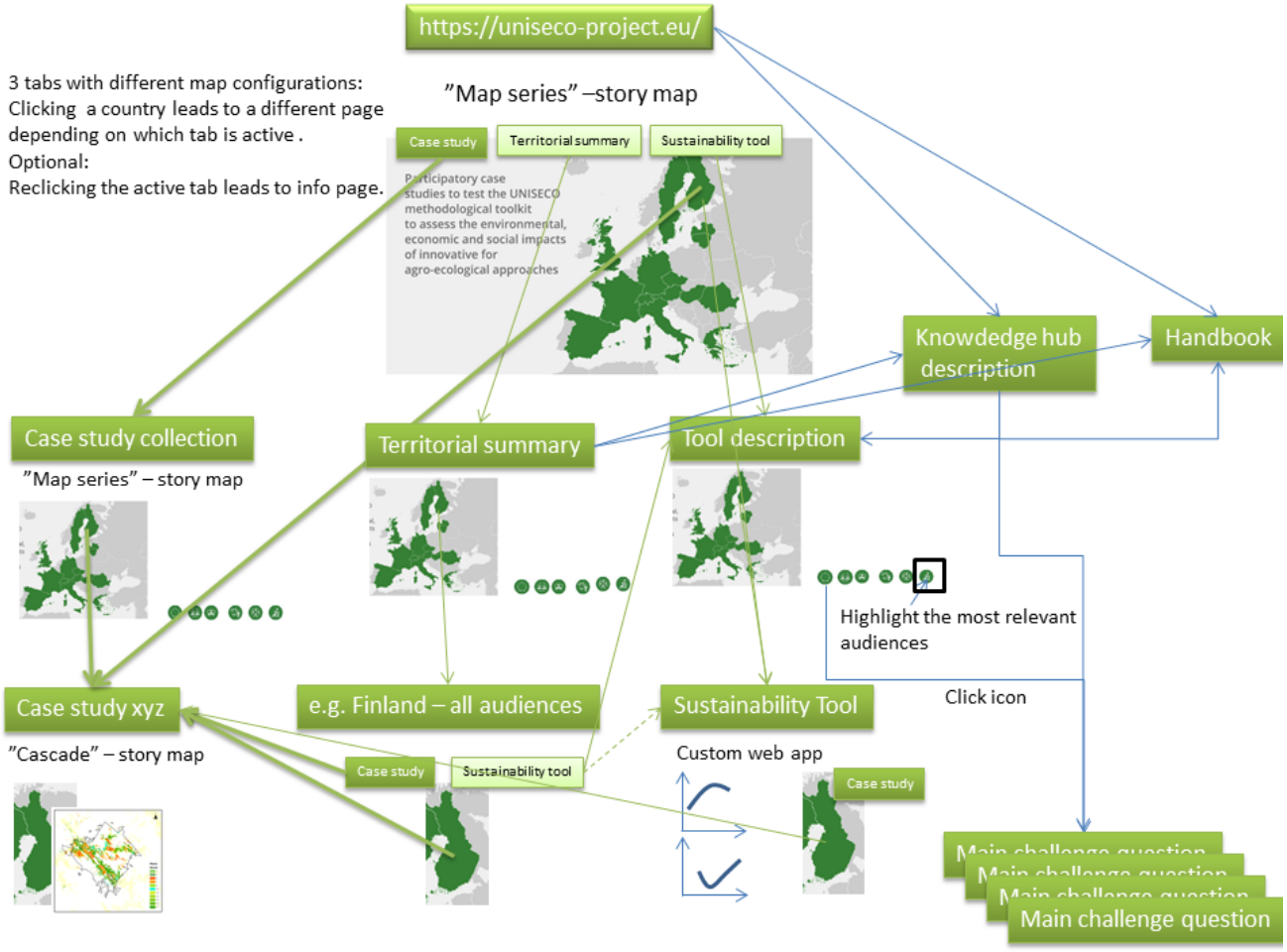

Figure 1. Tool structure and links to the principal elements of the agro-ecological knowledge hub.

The case study tab loads a map which shows all of the case study regions and a short description of what the displayed map contains. This includes a link to a further description of the case study approach in the UNISECO project (e.g. how the case studies were chosen). Clicking a case study region on the map opens up a info box of the case study and link that opens a new window containing the ("cascade") story map of that case (see section 4.2.1). Besides the maps of case study areas, the case study view in the navigation story map shows farms for each case study area, highlighting the perspective of the farmers and other value chain actors involved agro-ecological transitions to each case study with individual cascade story maps that are linked to the farm and case study location points.

The second tab on the entry map ("Territorial summary") loads a map of participating countries. Clicking on a country opens up an information box of key sustainability indicators relating to agriculture, derived from

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the statistics of that country. The link also opens a new page containing a summary of information specific to that country (for example the market instruments collected from that country). The country map shown contains an information box and a link to the cascade story map of related case study.

The "Territorial summary" map contains a link to the European Union level results which are not included in the interactive sustainability tool. The tool focuses on showing results that are suitable for use in interactive maps. The territorial summary page contains the navigation map with three tabs accessible from the UNISECO homepage. This is linked to the handbook, synthesis report and general information about the knowledge hub. The European wide summary page also has links from the national summaries.

The last tab on the entry page map is directing to the sustainability tool (section 4.1.2 and 4.2.2). It contains country polygons colour coded with sustainability score based on an indicator (for example based on sustainable development goals). Clicking on a country opens the customised web app of the tool (see Section 4.2.2).

4. TOOL FUNCTIONS

The tool functions to synthesise information that supports more sustainable decisions in agriculture. The main information delivery mechanism depends upon the target audience as explained in Section 3 on Structure.
Following the ideas of Ostrom (2011) on the importance of interaction between scientific information and (local) decision-makers, the design and specific functions of the tool are subject to feedback and the evaluation of non-scientific actors who are project participants or identified as important stakeholders on the local/country level (MAPs). It is these actors, in addition to farmers, for which the UNISECO project and the tool can provide technical assistance (function) regarding the most effective forms of resource management and will cover their experiences with, and perspectives on, agro-ecological transitions in the story maps.

For farmers, the technical assistance is provided in the form of: i) collecting and organising sustainability data, guided by trained project surveyors for the Decision Support Tools (Work Package 3); ii) for communicating information for 1 to 3 farms in each case study using the format of story map with the help of the project partners in the case study countries. The local farm, stakeholder champion and MAP involvement should lead to an increased awareness of effective ways of communicating key aspects and experiences of transitions to more sustainable farming systems in the case study areas. Once the case studies (local level) have been selected the feedback on the tool functions can be gathered from sources at that level.

The tool provides generic technical solutions which are suitable for backing up local monitoring and sanctioning efforts (as proposed by Ostrom, 2011) by the creation of data collection and communication practices which are scalable down to the local level using Geographic Information Systems (GIS). However, the testing and practical development of such functions is not feasible without commitments at a local level. Monitoring resource use locally depends upon the interest of local actors to commit to such self-monitoring systems. It is likely that such commitments would not exist, or be low in number, if the monitoring was proposed in a research project instead of through local agreements motivated by, for example, some resource use conflict evident to the local actors. The research driven development of functions concerning

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monitoring needs to take into account the new General Data Protection Regulation (GDPR) requirements in the European Union.

The tool can be used to visualize trade-offs between economic, environmental and social sustainability impacts of agro-ecological transitions (e.g. between agricultural income and biodiversity conservation), as well as emerging conflicts (e.g. zones of competing resource use). Such visualisation of trade-offs can be used in facilitating their resolution. However, the tools should not be viewed as an effective arena of conflict resolution in its own right as the conflicts that persist in farming are likely to be too complicated to be solved by only the provision of information to conflicted parties.

Detailed functionality of the tool will depend upon the content gathered for the group of target audiences and the geographic boundaries of the content collected.

4.1. Content

UNISECO contributes to the European Union Horizon 2020 Work Programme on Sustainable Food Security by identifying and supporting farming systems that enable the production of healthy food while preserving the environment and bringing added value to the farm households and the different stakeholders of the value chain. Examples of key aspects of the sustainability assessments of different pathways of enhanced implementation of agro-ecological approaches are the economic viability and labour productivity of farming systems, protection, restoration and promotion of sustainable use of terrestrial ecosystems and supporting policies to effectively target the reduction of GHG-emissions from agriculture.

The ability of future generations to meet their needs is seriously compromised by current developments regarding climate change (IPCC, 2018). The production of food, which is an essential good, can be a significant cause of greenhouse gas emissions. Climate change can adversely affect a large share of the global capacity for food production. So for sustainable development all these aspects need to be tackled simultaneously. Globally, this is a considerable challenge. Yet, human well-being is at the core of the definition of sustainable development by Brundtland (UN World Commission on Environment and Development, 1987), which is affected by needs and rights such as justice and equality.

Sustainable Development Goals (SDGs) were set by the United Nations to provide a 'shared blueprint for peace and prosperity for people and the planet, now and into the future' (https://sustainabledevelopment.un.org/?menu=1300). UNISECO links changes in farming practices to some of the key indicators of the Sustainable Development Goals, such as greenhouse gas emissions (SDG 13) and the protection, restoration and promotion of sustainable use of terrestrial ecosystems (SDG 15). There is a need to assess the overall significance of agriculture for specific indicators of Sustainable Development Goals, and within that the current and potential significance of agro-ecological systems based upon the results of farm level and territorial level assessments to be carried out in UNISECO.

The content provided in the online tool should follow ideas of Socio-Ecological Systems such as the facilitation of local self-organisation as a means of successful resource management. According to Ostrom (2011), success follows from supporting regulation of time, space and technology instead of quantity. In the context of greenhouse gas emissions this could mean, for example, the promotion of agro-ecological farming. Arguably this is only possible when there can be verification of reductions in greenhouse gas quantity from adopting specific practices. Thus, accurate information of the impacts at the case study level requires to be linked to wider impact at the territorial level. This means that when considering the impact of

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agro-ecological farming on SDG, the food supply needs to meet the food demand. Besides productivity, the changes in resource quality should be monitored (Byerlee & Murgai, 2001).

4.1.1. Story maps

Story maps (see Section 4.2.1 for technical aspects) will be used to describe the Socio-Ecological System of the case studies in UNISECO. Each case study Socio-Ecological System will be presented as a figure and displayed as a part of the story of transitions of agro-ecological farming, and thus more sustainable practices. The story maps will combine narratives of assessments and experiences of transitions to agro-ecological farming and, irrespective of the local context and priorities, cover shared key issues of sustainable agriculture, supported by quantitative information collected in Work Packages 3 and 4.

The experiences and assessments of agro-ecological transitions provided by the case studies form the core of the content of the story maps. They are supported by providing a broader sustainability context in a concise way. When relevant, the local stories of agro-ecological transitions should connect thematically to Sustainable Development Goals, and the quantitative territorial impacts of agro-ecological farming systems. The governance and policy assessment (Work Package 5) will produce a separate story line by combining the key outcomes of the assessment methods applied in the Work Package and their contributions to increasing suitability, such as when measured by Sustainable Development Goal indicators

When designing a story it should (adopted from Kalliomäki, 2015):

1. have a clear structure of beginning, middle and end;
2. a set of concise events (often structured chronologically);
3. causalities, and perhaps a plot;
4. be from the perspective of organizational story-telling with actions as the core narrative.
5. have a central character or actor (which could be a product or landscape);
6. contain facts,
7. appeal to human emotions (humanity, meaning, identification with actors in the story);
8. appeal to the senses (e.g. use adjectives derived from our senses).

WP6 will produce a template for story maps (Milestone MS22) which identifies the types of content required and defines a structure for the narrative to be used in the case study descriptions. The template can be accessed and edited through UNISECO ArcGIS online group. Two varieties of this template will be produced, one which focuses on telling the story from the perspective of a farmer, and the other with a broader, less targeted structure for describing the case study from the perspective of the Socio-ecological System including experiences and perspectives of key actors.

The story telling will use story maps, requiring information which represents the geographical dimensions of relevant Socio-Ecological Systems variables. The most basic spatial data which can be used is the location of farms chosen as part of the case study. If the case study area covers the whole country or a network of farms from different regions it is proposed that the farm locations are used to create a polygon which contains all of the farms that are part of the case study.

The template will support the use of short videos for presenting the farm story, as proposed by European level the stakeholders in agro-ecological farming.

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4.1.2. UNISECO customised web app

The story maps focus on presenting the in-depth analysis of SES case studies in easily understood terms. However, the heterogeneity of farming and the diversity of challenges related to sustainability make it difficult to generalise policy level conclusions from the case studies. Case studies or existing statistics are not sufficient for providing a broader view of the direction of change in European agriculture, and how agro-ecological transitions can affect it. There is a need to model the scope of the implementation of agro-ecological practices and assess the effects of implementation that can vary from region to region. Modelling is done at national and NUTS2 levels in Work Package 4, and at a finer resolution, providing spatially distributed information to be displayed in the tool. The tool has to be adopted to visualise content created for different scenarios to enable the inclusion of the work in Work Package 4.

Limitations on the delivery of scientifically based impacts of the sustainability of agro-ecological farming are set by the coverage and resolution of relevant data, as factors of the models used in Work Package 4. Where feasible, UNISECO aims to connect changes in farming practices, value chains and consumption to accepted sustainable development metrics providing evidence on the contribution to the Sustainable Development Goals. The following set of indicators summarises the different dimensions of sustainability for which the application could be explored within the tool.

4.1.2.1. Socio-economic

i. Total factor productivity growth (in agriculture)

- Introductory comment: Needs to be complimented with input resource quality and indices of production externalities
- Metric: Dimensionless; standard (sustainability) metric in the field of economics
- Sustainable Development Goal: Zero hunger, 2.3, double agricultural productivity by 2030; 8.2, achieve higher levels of economic productivity
- Spatial resolution: National level, NUTS 2 level
- Interpretations and trade-offs: Contradicting some potential indicators (less labour needed for satisfying food demand can lead to social issues in rural areas. Or, for example, irrigation can lead to productivity growth, which leads to unsustainable levels of water use in the long-run). This ignores the heterogeneity of fixed production factors.
- Explicit connection to Work Packages and tools used in UNISECO: Productivity of agro-ecological case study farms can be calculated with the data collected for decision support tools and compared with conventional farms (within case studies and with general statistics and FADN farms). However, the data collected is not sufficient for time series e.g. growth analysis within agro-ecological farming.
- Further information can be accessed from:
    - https://www.oecd.org/tad/events/Session%203%20Koen%20MONDELAERS%20PPT.pdf
    - http://www.worldbank.org/content/dam/Worldbank/Feature%20Story/SDN/Water/events/AWP/AWP2014-Session-4-Total-Factor-Productivity-Agriculture-KeithFuglie-Dec8.pdf

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ii. Labour productivity (in agriculture)

- Metric: Agricultural factor income per annual work unit
- Sustainable Development Goal: Zero hunger, 2.3.1 Volume of production per labour unit, 2.3.2 Average income of small-scale food producers, by sex and indigenous status
- Spatial resolution: National level, farm level to be explored in the case studies
- Interpretations and trade-offs: "Organic farms, although performing better in terms of energy efficiency, generally require more labor than conventional ones, ranging from about 10% up to 90% (in general about 20%), with lower values for organic arable and mixed farms and higher labour inputs for horticultural farms" (Gomiero *et al.,* 2011). Increase in labour productivity is associated with decreasing number of farmers. In UNISECO special attention is given to comparing labour productivity accounting for the production of private and public goods.
- Explicit connection to WPs and tools in UNISECO: SMART & COMPASS models' input includes the quantity of workers on farm. SMART collects information on the number of hours worked weekly. The COMPAS model includes in detail labour inputs to the different production systems and calculates economic indicators such as gross margin, net value added, net value added per annual work unit and farm income. FADN data and farm typologies can be used to make some rough generalisations based on case study results.
- Further information and references: Dorward (2013), Giannakis & Bruggeman (2018)

iii. Land productivity

- Metric: No of people fed per ha arable land
- Sustainable Development Goal: Zero hunger, 2.3, double (general) productivity
- Spatial resolution: NUTS2 level
- Interpretations and trade-offs: Lower productivity associated often with higher biodiversity and less nutrient pollution per hectare
- Explicit connection to Workpackages and tools in UNISECO: Output from BioBaM/SOLm
- Further information and references: e.g. Krausmann *et al.* (2013)

iv. Number of farms (time series)

- Metric: number of active farms (farms entitled to CAP subsidies)
- Sustainable Development Goal: Zero hunger (2.3). employment for all (8.5)
- Spatial dimension: Options are: i) the number of farms by NUTS regions; ii) the exact location of farms, or a heat map generated from time series for farms which are geographically located
- Interpretations and trade-offs: While a declining number of farms does not necessarily indicate a problem with the sustainability of food production, the lack of farm income can reduce local taxes, so endangering the quality of local public services, which could lead to unemployment and reduction in social capital. Compared to farm income and profitability, the number of farms is more stable and not as sensitive to volatile prices, which can be difficult to use in predicting long run socio-economic sustainability in farming communities. Possible increases in labour demand due to agro-ecological practices might not be captured accurately just by farm numbers (because on-farm labour could increase) and thus farm

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locations as such would not reflect at least the immediate impact of adopting some agro-ecological practices.

- Explicit connection to Work Packages and tools used in UNISECO: No models used in UNISECO predict farm numbers. SOL-M uses data on rural population. The overall labour impact of certain levels of diffusion of case study specific agro-ecological solutions can be reflected in models used in Work Package 4 of the overall labour demand of food production. This does not account of changes in farm structure but could be associated with national trends in the number of farms.
- Further information and references: Janker *et al.* (2019)

v. Market prices (time series)

- Introductory comment: Proxy for food security; reflect scarcity (of some inputs) over the long term
- Metric: Euro per product kg
- Sustainable Development Goal: Zero hunger, 2.C.1 Indicator of food price anomalies
- Spatial dimension: country level
- Interpretations and trade-offs: There is trade-off between farm social sustainability and food security, because higher (producer) prices increase farm profitability, but access for the general population (particularly in the lowest income brackets) to healthy food could suffer. Increasing prices can reflect scarcity of materials (e.g. unsustainable inputs).
- Explicit connection to Work Packages and tools used in UNISECO: The use of the CAPRI model in WP4 can provide information on possible impacts of agro-ecological farming on prices. If widespread adoption of agro-ecological farming reduces productivity Europe-wide, this could lead to increasing prices (under certain scenarios, such as constant demand). To demonstrate the impact of agro-ecological farming on food expenditure, based upon published literature, the biophysical scenarios in Work Package 4 can be associated with higher prices.
- Further information and references: Headey and Martin (2016), Meemken and Qaim (2018).

4.1.2.2. Environmental

Ideally environmental indicators would be related to damages caused by externalities or ecosystem services provided. However, in practice it is likely that poorer proxies will be used due to the lack of availability of suitable data (e.g. spatial resolution).

i. Greenhouse gas emissions (time series)

- Metric: CO2 ekv t per year
- Sustainable Development Goal: Climate action
- Spatial dimension: National level, farm level, possibly regional level
- Interpretations and trade-offs: In the short term, reducing greenhouse gases can decrease the profitability of farming, whilst over the longer term the productivity of farming could be reduced by climate change
- Explicit connection to Work Packages and tools in UNISECO: Work Package 3, Cool Farm Tool, SMART, COMPASS (farm level), SOLm (NUTS3 level)
- Further information and references: Wreford *et al*. (2017)

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ii. Air quality

- Metric: Ammonia emissions from agriculture (tonnes per year)
- Sustainable Development Goal: Good health and well-being, 3
- Spatial dimension: National level, farm level
- Interpretations and trade-offs: Some technical solutions to control greenhouse gases could increase emissions of ammonia; improving animal husbandry could also reduce greenhouse gas emissions, and possibly reduce farm income.
- Explicit connection to Work Packages and tools used in UNISECO: Cool Farm Tool (farm level) contains information about application methods and quantities of manure used.

iii. Share of renewable energy in gross final energy consumption by sector

- Metric: Proportion of renewable energy in gross final energy consumption by sector
- Sustainable Development Goal: Affordable and clean energy, 7
- Spatial dimension: National level
- Interpretations and trade-offs: some agro-ecological practices can lead to an increase in the consumption of (non-renewable) fuel
- Explicit connection to Work Packages and tools used in UNISECO: work in Work Package 3, and the SMART, Cool Farm Tool (farm level), and SMART (farm level) tools. There is no explicit sector or national level assessment tools in the project, which are used to predict the use of renewable energy in agriculture. Case studies and typologies may be used to make approximations of the overall impact at the sector level.

iv. Nitrogen and Phosphorus balances (time series)

- Introductory comment: With links between soil type and load
- Metric: gross nitrogen balance
- Sustainable Development Goals: Zero hunger, 2; Clean water and sanitation, 6
- Spatial dimensions: National level, regional level, farm level
- Interpretations and trade-offs: Low Nitrogen and Phosphorus balances can imply lower productivity per ha, which could lead to larger areas of cultivation being required for food production, with consequences of negative impacts on forested areas as well as nutrient pollutants and greenhouse gas emissions
- Explicit connection to Work Packages and tools used in UNISECO: Cool Farm Tool (farm level), SOLm, and SMART models contain the information required to calculate the balances (for the case study farms and for connecting the nutrient balance with food scenarios)
- Further information and references: Guidance has been developed by the OECD which is widely applied in Europe, e.g. OECD (2013).

v. Natural capital stocks

- Metric: Estimated soil erosion by water (Sustainable Development Goal 2); Share of forest area (Sustainable Development Goal 15); Soil carbon (as an indicator of sustainability problems and uses); Water use-efficiency (Sustainable Development Goal 6)
- Spatial dimension: To be decided

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- Interpretations and trade-offs: Depleting stocks can be economically and socially viable in the short-term, but unsustainable in the long term.
- Explicit connection to Work Packages and tools used in UNISECO: SMART contains a binary variable of conflicts due to water quality; Cool Farm Tool contains information on soil carbon change, forest cover, and an indicator of water scarcity; SOLm contains information about water and wind erosion and forest area.
- Further information and references: e.g. Science for Environment Policy (2017).

vi. Farmland biodiversity (Protect biodiversity and habitats)

- Metric: Habitat diversity (Sustainable Development Goal 15); Share of semi-natural habitats (Sustainable Development Goal 15); Share of High Nature Value farmland or share of agricultural land managed for biodiversity benefits (Sustainable Development Goal 15); Species diversity (Sustainable Development Goal 15).
- Spatial dimension: To be decided.
- Interpretations trade-offs: Intensification and specialization of farming systems (and the linked overuse of ecosystems) can increase short-term economic viability, but lead to loss of biodiversity and are unsustainable over the long term.
- Synergies: Internalisation of biodiversity benefits into agro-ecological farming systems can increase long-term economic viability and contribute to the protection, restoration and promotion of sustainable use of terrestrial ecosystems.
- Explicit connection to Work Packages and tools used in UNISECO: Cool Farm Tool contains indicators of habitat and species diversity in the biodiversity assessment module; models used in Work Package 4 provide spatially explicit information on land cover and land use (at the NUTS2 scale).
- Policy relevance: Key theme and indicator for the monitoring and evaluation of the CAP.
- Further information and references: Eurostat (2018) https://ec.europa.eu/eurostat/statistics-explained/index.php/SDG_15_-_Life_on_land#Biodiversity

vii. Area under organic farming

- Metric: hectares (ha)
- Sustainable Development Goal: Zero hunger, 2.4 and 2.5
- Spatial dimension: National level
- Interpretations and trade-offs: Productivity under organic farming is expected to be lower than in conventional farming. This leads to pressures of a declining share of forest area (Sustainable Development Goal 15), and limiting the use of pesticides can increase tillage which in turn leads to increased soil erosion.
- Explicit connection to Work Packages and tools used in UNISECO: At the case study level for SMART data is gathered from organic farms, which can help to illustrate the problems of using organic land area share as a proxy of resilient farming practices, and for the development of more accurate indicators.
- Further information and references: Meemken and Qaim (2018), Ponisio *et al*. (2015), Badgley *et al.* (2007)

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4.1.2.3. Social

i. Population

- Metric: Population count
- Spatial dimension: National, NUTS2 level, or use of a different means of spatial representation (e.g. gridded)
- Interpretations and trade-offs: Population growth provides conflicting information in terms of different sustainability dimensions. Population growth can lead to increasing pressures on the use of resources, but such growth provides an expanding economic base for industries and government services. Estimates or counts of population are important for agro-ecological farming for matching with the quantity of food required to feed people. A reduction in the labour force due to a reduction in population in Europe could increase labour prices. In turn, this could be harmful for more labour intensive agro-ecological farming approaches. Demands for agricultural labour could be related to patterns of population migration.
- Explicit connection to Work Packages and tools in UNISECO: SOLm in Work Package 4 is used to predict the amount of food needed to feed the population in Europe, and so includes data on population
- Further information and references: Boserup (1965), Willy *et al*. (2019).

ii. Gender-related issues

- Introductory comment: Availability for just the agriculture sector or farms
- Metric: Gender employment gap (Sustainable Development Goal 5), Gender pay gap (Sustainable Development Goal 5)
- Sustainable Development Goal: Gender equality, 5
- Spatial dimension: National (regional if available)
- Interpretations and trade-offs: It is unclear whether efforts to reduce the gaps in gender employment and pay could lead to reducing the rate of increase in labour productivity
- Explicit connection to Work Packages and tools in UNISECO: SMART contains a variable for 'equal pay' (this is a qualitative variable in the model); the assessment of gender employment gaps can be informed by some variables in SMART and interviews of actors in case study.
- Further information and references: Currently, indicators of human well-being such as nutrition, gender equality, and empowerment are poorly represented in models used for assessing sustainability (Kanter *et al*., 2019).

4.2. Technical

4.2.1. Story maps

"Story map" is a term formulated to describe a web page consisting of linked text, photos, videos and figures including maps with which users can interact in different ways. Such a combination of elements of a story can be used to create an easily read, compelling and authorative means of presenting information.

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The story map is a web application, accessed by a web browser independent of the viewing device. As the term “Story map” implies, a particular emphasis is placed on maps as means of information delivery.

Traditional uses of maps are as tools for navigating from one place to another, and representing the boundaries of areas of ownership or authority. As the availability of spatial data has increased, and access to map-based information, so has the familiarity with maps as a backdrop for a wide range of information and uses.

Story maps enable the user to interact with information associated with maps. The geographic information conveyed as a map within a story map can be navigated through and inspected using the range types of functions which are common place. Such functions include zooming in and out of the map, panning to different regions, and viewing in different orientations, and used as a backdrop for the identification of specific features and access to further information with the click of a button.

Story maps can be designed in ways that are most suitable for the needs of the target audiences. In the UNISECO project, pre-set ways of defining the user experience are provided from the Esri Story Map apps which provide a structure for the content. To access the apps the content provider logs into the Esri ArcGIS–online service using a web browser. From there they can choose the type of story map template to apply and then add text, types of maps, and content types through a “what you see is what you get” type of user interface.

Two types of templates are required to be populated for each case study: i) Specific stories from case study farms; ii) Stories summarising key case study aspects and experiences from different key actors including the researchers. In UNISECO, the list of case studies is created using the “Map Series”. The “Cascade” story map is the basic template to be used for gathering and presenting case study information. This template provides the structure for the presentation of the information (i.e. the order and placement of the text, links, maps and other types of media), and the default visual elements and styles of the project (i.e. logo, fonts etc.). Instructions regarding the types of narratives and immersive elements of the tool are provided for populating the template. In depth guidance on the building of cascade story maps is provided at: https://www.esri.com/arcgis-blog/products/arcgis-online/local-government/how-to-cascade/

The “Cascade” app has been chosen for presenting the case studies due to its ease of use, navigation, and suitability for in-depth story telling compared to the other apps which are more map centric. However, it is not the most appropriate means of integrating other story maps within the cascade.

The “Map Series” story map is an app which is well suited for providing an overview of the UNISECO case study areas. This app will link to the “Cascade” story maps, as well as to the overview of the case, and each country.

The story map apps can utilise maps created in ArcGIS online and other GIS tools which are then uploaded directly to ArcGIS online or linked from other web hosting services. This provides project partners without the technical capabilities in Geographic Information Systems the scope for creating maps of relevance to the case studies and presenting them as a part of the story.

In parallel to the templates being populated with data relating to the case studies, opportunities for the use of other functionality, such as “Swipe” and/or “Spyglass” apps, will be investigated for purposes such as visualising data created from other work packages.

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4.2.2. UNISECO customised web app

The story map apps are designed and implemented to enable the telling of stories in an effective way and to let users interact with spatial content. They are not intended to enable complex spatial analysis. To extend the functionality of the UNISECO spatial online tool beyond the functionality of the story maps, a customised web app is being developed. As with the story maps, an app development environment created by Esri is being used in UNISECO, which can be created through a web browser in ArcGIS online.

The customisation of the web application can be at different levels. Advanced options enable the developer to add different types of map and user interactions from an existing list (of so called widgets), and to configure the visual elements freely (themes). Further customisation is possible by programming new widgets.

As with the story maps, the main function of the customised web application is to provide synthesised information based on the results obtained from Work Packages 3 to 5. For the customised app, the focus is on spatially distributed information.

The UNISECO tool app will include a graph widget which summarises data in a figure based on what is visible in the map view. These graphs will be dynamically updated from the contents of the database.

The theme proposed to be used in the UNISECO customised web app is based on web app called "Operations Dashboard". Although this app is oriented towards serving real time information, the focus of the development of the customised web app will be on visualising time series data using inputs from different spatial scales and based on different scenarios. By matching various (typically annually updated) statistical sources with the project modelling tools, the tool will visualise indicators of sustainability and compare them with the values derived from the case studies.

The application programming interphases (API) will be explored in the tool development phase in cooperation with the other project Work Packages, in particular Work Package 4.

Some tool features which will be investigated in the custom web app builder are:

- Mapped time series data (for example farm location in different years)
- Auto updated figures based on what is visible on a map
- Allowing users to set weights for averaging different sustainability indicators and displaying the results in infographics or maps

5. TOOL DATA MANAGEMENT

Project data will be collected in 15 countries corresponding to the locations of the organisations which are partners in the UNISECO project. The basic project data management practices are described in the Data Management Plan (Schwarz and Miller, 2018; D1.3). The main sources of data collected in the project are through the case studies. These data are supplemented by qualitative and quantitative assessments and territorial level models. Both the story maps and the customised web app utilise secondary sources of data such as the Sustainable Development Goal indicators managed by the European Union statistical services (Eurostat, 2019).

In the first stage of the project, the primary data storage for the tool will be the ArcGIS–online server, which ensures easy access, and compatibility with Esri Story maps and the customised app development

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environment. Initially, all of the GIS layers produced in the project will be stored in ArcGIS online. For serving the published tool, it is proposed to use the WWF ArcGIS–server, to be accessed through The Global Observation and Information Portal (GLOBIL). This solution is currently being discussed with WWF, which would mean that a relevant stakeholder would take over the upkeep of the service after the research project has finished. A written agreement concerning the duration of the service and conditions set by the WWF and the UNISECO consortium will be drafted in Work Package 6 at a later stage of the project.

The data from the case studies are collected by the organisations responsible for implementing the case study in each country. The majority of the spatial data are stored as features represented using polygon and point data structures. Some raster datasets will be included to represent certain types of data in individual case studies. The data will be used to populate a story map template and the GIS database. These resources will be accessible by logging in to the UNISECO group within ArcGIS online.

Access to ArcGIS online is managed by Work Package 6. Where partner organisations have ArcGIS online licenses these will be utilised where possible. For the other partners, a license or joint license with other partners will be granted by Luke for the duration of the project.

Through the use of ArcGIS online, all partners responsible for case studies are able to record the locations of the participating farms on a map background. It is also possible to upload the information about the farms (in one file, including relevant attributes) to ArcGIS online group of UNISECO. Technical assistance is being provided by Work Package 6 where required. Instructions are being prepared regarding the requirements and nature of the metadata to be recorded as part of the GIS layers in which the case studies are represented.

6. INTENDED IMPACTS OF THE TOOL

As described in Section 4 (functions), the main purpose of the tool is to deliver information that can lead to decisions that improve the sustainability of agriculture. The aims of the stories provided through the tool are: i) the demonstration of compelling ways of how farmers have been able to transition to more sustainable practises; ii) illustrating the challenges which had to be overcome for this to happen; iii) and showing the roles and experiences of other actors, such as advisors and value chain actors, in promoting this process. The stories will be complemented by quantitative information (both from the case studies and territorial level analysis) presented as graphs and interactive features summarising sustainability indicator data.

The process of developing the tool is increasing the capacity of the project to communicate on issues relating to sustainability, which is an important element of successful transitions to more sustainable practises. The aim of building capacity within relevant partners regarding the use of Story map tools is being supported by sessions at the partner meetings, and one-to-one guidance. This will be expanded as the project goes into its final 2 years.

An aim of the engagement with local actors is that farmers, advisors and value chain actors who are part of the project case studies will learn about the existence and functionality of the tool. Their feedback will continue to be sought on the content and functionality of the tool to improve its usability. The actions sought are the contribution of content and use of the platform to disseminate information about best practices with a view to changing consumer behaviour, value chain practises and agricultural policies. The

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overall impact sought is to facilitate transitions towards more sustainable agriculture through increased connectivity between actors using the tool, and operational changes in farming practices.

Farming within the European Union is guided by supra-national, national and regional level policies. The tool is being designed and implemented to increase the awareness of policy makers of the effects of agro-ecological practises on sustainability. The aim is to provide evidence that could support instrumental impacts (e.g. the identification of options for policy, and development of guidelines and the Handbook for practitioners). In particular, the approach to its design and contents is to illustrate the practical challenges faced by farmers, and the influence that policies have both in creating these challenges and solving them. The quantitative scenarios presented in the tool illustrate the relevance ot local solutions to global sustainability challenges.

Given sufficient traction amongst the different stakeholders, the aim is that the tool can collect and disseminate an increasing number of stories relating to more sustainable farming practises. The dissemination will be targeted towards people tackling the fundamental dilemma faced by the project of how to produce public goods whilst having viable production of private goods, securing economic and social sustainability at a farm level, which is not overly dependent on public funds. The planning for support of the tool once the UNISECO project is complete, through WWF, is in recognition of the long-term nature of transitions to agro-ecological practices, and the intention to support such transitions as a legacy of the project.

7. MULTI-ACTOR PLATFORM FEEDBACK

Feedback on the tool concept was collected on two separate occasions. The first took place on 1st March 2019 in Brussels, Belgium, and the second in Helsinki, Finland, on 9th May 2019. On both occasions, the main target was the UNISECO EU-level Multi-Actor Platform, which comprises stakeholders relevant to agro-ecology and the sustainability of farming systems in the EU. Members of the Stakeholder Reference Group (SRG) with representatives of the case study MAP and the Project Advisory Group (PAG) also took part in the consultation held in Helsinki.

Prior to the workshop arranged in Brussels, the concept note of the spatial online tool was circulated to members of the EU-level MAP who were going to participate in the joint workshop on scenarios and tool development. The note was sent 6 days in advance of the workshop, to 14 members of the EU-MAP, of whom 10 eventually participated.

At the workshop in Brussels, March 2019, a short presentation was made of the prototype story maps developed for use in UNISECO, and the key elements of the concept being implemented. Then participants were invited to consider a set of questions, listed below:

- To what extent have we designed a tool that you would use? If you would not use it then why not? If you would use it, why?
- Many tools like this are never used the second time. What functions would make you use the tool regularly?
- Thinking about content (Section 4.2), are there some sustainability dimensions / indicators that are missing? What data source could be tapped for development of this dimension/indicator?
- Have you seen something that was appealing and useful to you, and if so what features in particular?

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The summary of the opinions of members of the EU-level MAP is based upon the one hour discussion at the workshop. The discussion was principally around sustainability indicators. Few comments were received regarding the technical or Socio-Ecological Systems aspects of the concept.

Participants reported having seen different tools of which some were considered important to be aware of. However, participants did not identify functions or features in these tools which should be included in the UNISECO tool.

The EU dashboard, the reporting site for the EU Sustainable Development Goals, and FAO's agro-ecological hub were identified as examples of related topics, and the websites of several EU projects, some of which some have map interfaces, were highlighted. The feedback did not include examples which include spatial data at a finer spatial resolution than the conventional NUTS divisions.

The principal points raised in the discussions were:

i) the topics of ecosystem services in general, and the use of biodiversity as an indicator;
ii) the questioning of the use of farm numbers as an indicator, with labour use considered as a more appropriate choice;
iii) farmer age structure, pesticide use and the area under agri-environmental schemes were highlighted as being of relevance;
iv) general acceptance of the benefits of using the Sustainable Development Goals;
v) a recommendation to focus on presenting the case studies instead of presenting existing indicator data in the tool;
vi) modelling should go beyond the case studies and provide more content directly from the UNISECO project itself;
vii) transition was seen as an important concept in building the tool;
viii) no stakeholders opposed the proposal that WWF would take over management of the tool after the project finishes.

The workshop in Helsinki, May 2019, comprised a brief introduction to the concept of the tool, including a demonstration of the story maps for both navigation through the topics, and the case level from the farmer's perspective. Fourteen members of the EU-level Multi-Actor Platform, Scientific Reference Group and Project Advisory Group participated in the workshop, of which two had participated in the workshop in Brussels.

Workshop participants were divided into three groups, one for the EU- level Multi-Actor Platform, Scientific Reference Group and Project Advisory Group, and one for the researchers.

The groups were presented with three questions concerning the tool:

1. What features would add value to what exists already?
2. What types of information would be useful for you from such a tool?
3. What indicators coming from Work Packages 3, 4 and 5 do we want to be sure we capture in the online tool?

Each group was asked to start with a different question. The EU-level MAP started with question 1, the PAG-SRG group with question 2, and the researcher group with question 3. The following is a summary of the key points made by the stakeholder groups.

The discussion of the EU-level MAP focused mainly on the story aspect of the tool. Both the temporal and spatial context of a story were highlighted as important aspects in the design of the tool. In its stories,

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UNISECO should consider the past (i.e. history), to illustrate history of policies as well as that of the farm or farmer.

Telling stories about the past can be used to recontextualise what is happening in the present day, and to facilitate change. Furthermore, transition itself is a process in time that should be described in a story. The UNISECO story could include elements that describe connectedness of the themes which agro-ecological solutions can address with other actors, and factors of relevance beyond those of agriculture.

The stories should be written with specific audiences in mind. They should link to existing material on agro-ecology with materials provided by FAO, PLAID and NEFERTITI and H2020 agri-demonstration projects identified as relevant examples. Several members of the EU-level MAP identified the use of video materials as effective means of communications, as illustrated by their use on social media networks.

It was recommended that the stories would focus on agro-ecological solution. In addition, language issues need to be accounted for in the story map design. Finally, there was encouragement for a more detailed description of how scenarios (Work Package 4) and insights into policy contexts (Work Package 5) could be incorporated into the tool contents.

The points raised in the group of the Stakeholder Reference Group and Project Advisory Group covered similar topics as those raised by the EU-level MAP. These included the need to define target audiences, the importance of considering the languages in which the information is presented, the question of temporal data, benefits of including videos messages from farmers, and other issues such as data security and gender related factors.

The outputs of the discussions will inform development of the spatially explicit tool. A similar approach will be used for the conceptual development of the handbook in Task 6.4, referenced in Section 8.

8. METHODOLOGICAL HANDBOOK FOR TRANSDISCIPLINARY SUSTAINABILITY ASSESSMENT

In addition to the interactive spatially explicit tool and the multi-actor networking facility, a third key element of the UNISECO Agro-ecological Knowledge Hub is a methodological handbook for transdisciplinary sustainability assessments of agro-ecological farming systems.

Key objectives of the UNISECO project are to develop transdisciplinary approaches for the assessment of the sustainability of agro-ecological farming systems and to improve the integrated capacity of end-users, stakeholders and scientists to conduct such assessments of EU farming systems. The transdisciplinary approach integrates knowledge from across academic disciplines and the science-policy-practice nexus into the sustainability assessment of farming systems and places a strong emphasis on participatory processes to foster co-learning and co-construction.

The methodological handbook will describe the processes and methods required for a transdisciplinary sustainability assessment, combined with practical guidelines on how co-construct and assess management strategies promoting agro-ecological transitions. It will also take into account the lessons learned from the experiences of the UNISECO case studies and territorial assessment. The handbook will build on the transdisciplinary guide (Deliverable D7.2, Irvine *et al.*, 2019) and the conceptual framework (Deliverable D2.1, Guisepelli *et al.*, 2018) and typology of agro-ecological farming systems (Deliverable D2.2, Prazan and

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Aalders, 2019). It will be targeted at scientists and practitioners who are involved in the design, implementation or evaluation of sustainability of farming systems.

This section outlines the main purpose of the handbook and a first reflection of the key elements it will include. As defined in the Project Management Plan (Deliverable D1.1, Schwarz *et al.*, 2018) the concept and structure of the handbook will be developed in more detail in Task 6.4 in December 2020.

The main purpose of the handbook is to offer scientists and practitioners guidelines when planning and carrying out agro-ecological approaches for enhancing sustainability in co-construction settings. The handbook aims to address the following:

- How to design a transdisciplinary sustainability assessment and involve key actors in such an assessment.
- How to identify and address the main barriers for agro-ecological transitions.
- How to foster co-learning and to derive lessons learnt for future management strategies for the promotion of agro-ecological transitions.
- How to co-construct management strategies for agro-ecological transitions in different local and territorial contexts.
- How to inform the policy-science dialogue.

It is envisaged that the methodological handbook will provide flexible guidance to scientists and practitioners on a process for designing transdisciplinary sustainability assessments of agro-ecological farming systems. It will not be an 'off the shelf' recipe book. Instead, the handbook will present a range of possible solutions (e.g. depending on different socio-cultural contexts of cooperation and participatory research). The aim will be to provide a basis for deciding on the most consistent and suitable approach for use in the sustainability assessment.

The handbook is developed around a logic model of the process of assessing sustainability for enhancing agro-ecological transitions in co-construction settings. This builds on the experiences with logic model based handbooks of the ENVIEVAL project that were adopted in the guidelines for the assessment of RDP achievements and impacts in 2019 developed by the European Evaluation Helpdesk for Rural Development (European Evaluation Helpdesk for Rural Development, 2018). The handbook functions as a methodological framework, guiding scientists and practitioners through the co-construction and assessment of agro-ecological transitions. It suggests different routes depending upon factors such as the type of farming system and agro-ecological practices, socio-cultural context and experiences of actors, data availability or different sustainability challenges to be addressed by the intended transition. The step-by-step flow of the logic model(s) will help in the design of a consistent transdisciplinary assessment workflow.

The conceptual description of the different transdisciplinary assessment steps will be supported by practical examples of their application. These supporting materials include fact sheets of the participatory approaches and assessment methods tested in the UNISECO project which provide information about their strengths and weaknesses in transdisciplinary sustainability assessments of agro-ecological transitions of farming systems. At this stage the following key elements and sections are expected to be in the contents of the handbook:

- Key challenges of transdisciplinary sustainability assessments of agro-ecological farming systems
- Explanation of the methodological framework for transdisciplinary sustainability assessment

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- Step-by-step guidance on applying the framework for the co-construction and assessment of agro-ecological transitions
- Lessons learnt from UNISECO applications for different target groups of the Agro-ecological Knowledge Hub
- Fact sheet style presentation of information

In activity 6.4.3 of the Project Management Plan of UNISECO, the development of the concept and structure of the handbook is scheduled for autumn 2020. Activity 6.4.6 comprises a consultation with MAP in early 2021. This will take place in workshop sessions with the UNISECO MAPs to ensure its relevance to the different types of practitioners they represent. The final handbook will be made available in electronic form, accessed from the project website as a part of the information content in support of the Agro-ecological Knowledge Hub.

The handbook will form part of the range of guidance documents dedicated to sustainability assessments of farming systems, e.g. guidance on sustainability assessments of food and agricultural systems developed by the FAO (FAO, 2013), and a handbook on agroecology: farmer's manual on sustainable practices (FAO, 2014). Its development will build on previous experience with equivalent handbooks such as a handbook on evaluation of environmental impacts of rural development programmes on public goods including HNV farming (Morkvenas *et al.*, 2015), and a policy handbook for result-oriented measures for biodiversity in mountain farming (Stolze *et al.*, 2015). The added value of the UNISECO handbook compared to other existing handbooks and guidance for sustainability assessments will be the emphasis on transdisciplinary approaches and the thematic focus on agro-ecological transitions in Europe.

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