

PROVIDE

PROViding smart DELivery of public goods by EU agriculture and forestry

Call identifier: H2020-ISIB-2014-2; Topic: ISIB-01-2014

Funding scheme: Research and Innovation Action (RIA)

Duration of the project: 01 September 2015 – 31 August 2018

Deliverable D4.4

Report on public goods valuation guidelines

Version: 30th January 2018

Organisation name of lead beneficiary for this deliverable:

University of Córdoba – UCO

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Dissemination Level		
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List of abbreviations

AES: Agri-environmental schemes

AFS: Agricultural and forestry systems

AHP/ANP: Analytic Hierarchy Process / Analytic Network Process

CSR: Case Study Region

CV: Contingent valuation

DCE: Discrete choice experiments

DoA: Document of Agreement

DPSIR: Driving forces, Pressures, States, Impacts, and Responses (approach)

EU: European Union

GM: Governance mechanism

HS: Hotspot

NGO: Non-governmental organisations

PGBs: Public goods and bads

VM: Valuation method

WTP: Willingness to pay

WP: PROVIDE project's work package

1 Introduction

This report summarises the main lessons learned from the tasks addressed within **Work Package 4 (WP4) “Improved valuation of public goods”** in the context of the European Union (EU) Horizon 2020 project PROVIDE (PROViding smart DELivery of public goods by EU agriculture and forestry). Accordingly, it mostly relies on the results obtained throughout this work package, described in the three precedent deliverables (Villanueva *et al.*, 2017b; Villanueva *et al.*, 2017c; Villanueva *et al.*, 2017d).

The main objective of this report is two-fold. Firstly, to outline the main results obtained from the demand-side and supply-side valuation assessments carried out, underlining their key policy implications. Secondly, to provide guidelines for the valuation of the main public goods and bads (PGBs) supplied by agricultural and forestry systems (AFS) at the most adequate scale. This includes information about how to use the main valuation tools from a methodological and practicability point of view, with a special emphasis on the involvement of stakeholders in the valuation process and the handling of adaptation issues.

Within the PROVIDE Project, this report addresses **Task 4.6** “Lessons learned and guidelines per tool”, it is also connected to **WP2** sub-task 2.2.4, concerning the 3rd round of stakeholders’ workshops at case study region (CSR)² and EU level; **WP5**, especially with regards to policy implications drawn from WP4 results; and **WP6**, in particular to dissemination activities which can be relevant for policy-makers, practitioners and the general public on the arena of valuation of PGBs.

This report is organised as follows: Section 2 outlines basic concepts to contextualise the valuation of PGBs provided by AFS. Sections 3 and 4 focus on the valuation of benefits and costs of these PGBs respectively (corresponding to demand and supply-side valuation), providing general guidelines to carry out this type of assessments and main lessons learned with regards to the adoption of participatory approaches (with stakeholders) and the selected valuation methods. Section 5 focuses on the key policy messages which arise from the results obtained from the wide variety of valuation exercises carried out, while Section 6 concludes.

² Within the project, CSR refers to the regions under analysis, where there can be different AFS or areas representing hotspots (HSs) of significant provision of PGBs.

2 Valuating public goods and bads (PGBs) provided by agricultural and forestry systems (AFS): Setting the scene

The provision of PGBs by AFS is the result of complex processes developed within these systems and include many different dimensions, from purely ecological and biophysical to socioeconomic. We analyse the amount of PGBs provided by AFS because it matters to individuals in a society, since any change in the level of provision of these types of goods may lead to changes in different people's welfare. An approach to analyse this issue is to value these welfare changes using comparable units (commonly in monetary terms), especially focusing on the support of decision-making (mostly public, but not only) regarding the implementation of governance mechanisms (GMs) to promote a "smart" provision of PGBs by AFS. Therefore, there are several reasons for **why** to value these goods and bads: i) to disentangle the complex socio-ecological relationships behind their consumption and provision; ii) to make explicit how human (producers') decisions can change the level of provision of these goods; iii) to check which PGBs are more demanded by members of a society and to analyse which variables (individuals' characteristics) are affecting this valuation; and iv) to provide information on how (at what costs) these PGBs are provided by the different AFS; and v) to express these value changes in commensurable units (e.g. monetary) able to be incorporated in governance decision-making processes.

In a first step, it is worth identifying **what** it is to be valued. Firstly, we have to identify the PGB which affects society and to what extent this PGB is produced by AFS. To distinguish a situation where a farmer/forester provides a PGB, we propose the following: s/he provides a PGBs when her/his decisions entail some modification of the attributes of the environment (providing them to be – mostly– non-excludable and non-rival) that changes the social welfare. Here, the environment must be considered in a broad sense, that is, formed by natural (climate, water, biodiversity, etc.) and socio-cultural (cultural heritage, rural viability, etc.) attributes. These attributes are the ones that are valued (either positively or negatively) by society. Thus, typically it cannot be affirmed that they are produced by AFS, but that the quantity and/or quality of these attributes important to society can vary depending on farmers/foresters' land management practices at the scale of the farm or forest holding. Consequently, farmers/foresters produce a *public good* when they modify one of these non-rival and non-excludable attributes, and social welfare increases as a result; and on the contrary, a *public bad* when such modification results in a reduction of social welfare. As explained in Villanueva *et al.* (2017d), the natural and socio-cultural attributes of the environment can be considered as *states* (*PGB-States*), following the DPSIR (*Driving forces, Pressures, States, Impacts, and Responses*) framework. When some of these non-excludable and non-rival *states* are modified as a result of farmers/foresters'

decision-making and this modification entails some variation of social welfare, a *pressure (PGB-Pressure)* is produced. Therefore, when a farmer/forester produces a PGB, s/he is in fact producing a pressure (positively or negatively) changing the states of such goods.

Once we have identified that we are measuring (valuing) pressures on the environment, it is worth noting that AFS are not the only activity producing pressures on the attributes of the environment. It is crucial to separate AFS's pressures from those generated by other activities to adequately value the changes in the levels of quantity and quality of the attributes of the environment derived from farmers/foresters' decisions, i.e. to value their provision of PGBs.

The pressures from AFS on the natural and sociocultural environment result in benefits/losses to members in society, and are produced at a certain cost to the farmers/foresters. From the valuation perspective, it is worth distinguishing two common situations: the *improvement*, and the *maintenance*, of provision of PGBs. These two situations refer to those characterising market failures due to current and expected future under-provision of PGBs respectively. With regards to improvements, where a change in the level of provision PGBs is desired by society (as higher benefits are expected from that change), some measures would need to be taken to achieve that level. These measures would usually result in some additional costs, as the costs of provision of PGBs initially borne by farmers/foresters (at least their perceived costs) can be presumed to be negligible (in the situation without the measure). The situation in which the maintenance of the level of provision of PGBs is desired by the society is different. When current provision of PGBs is at risk, for instance because of low profitability of agriculture/forestry (which leads to either intensification of production or farm abandonment), if no measure is taken the provision of PGBs would be worsened³. Here, farmers and foresters are bearing certain costs of provision of PGBs (especially in the form of opportunity costs related to forgo more profitable options), while the society is benefitting from such provision. Therefore, from the valuation point of view, it is important to distinguish between both situations as they would entail different valuation framing, basically focusing on higher costs of and benefits stemmed from the improved provision of PGBs (for the improvement situation), and costs of remaining the current provision of PGBs and benefits stemmed from avoiding an expected under-provision of them (for the maintenance situation).

Related to this, from the valuation perspective it is also paramount whether it is the benefits for improved provision of PGBs or losses for worsened provision of them which are to be valued. The reasoning behind is that, as economic literature has long evidenced, there is usually a discrepancy

³ Logically, it is worth noting that if the provision of PGBs by AFS are predicted to remain at the level socially desired, no measure needs to be implemented (i.e. there is not current or expected market failure).

between gains and losses (Kahneman *et al.*, 1991), especially concerning public goods (Bromley, 1991; Bateman *et al.*, 2009). This refers to the endowment effect and should be considered when investigating maintenance or improvements in PGBs provision by AFS, with the former focusing on avoidance of losses and the latter on the achievement of benefits compared to the status quo situation. In this regard, it is worth noting that in environmental valuation there may be a subjective element as to what constitutes a good and a bad and hence gains and losses (Byg *et al.*, 2017)⁴.

All this corresponds to general concepts that have to be recognised prior to carrying out any valuation assessment of PGBs provided by AFS. However, on the move from the general to the specific, there are many issues that arise, particularly those related to such a transboundary field, embodying not only economics but also ecology, agronomy, sociology, hydrology, among other sciences. For example, if we are valuing benefits/costs related to changes in farmland biodiversity as a result of farm-level decision-making, to accurately identify the change to be valued we need to set (ecological or socio-cultural) indicators to measure such a change, ensure that there is available information about the initial and final situation with regards to these indicators, and understand to what extent, and under what timescale, this is attainable (which involves to what extent the change can be achieved as a result of modifying farmers' resource allocation), among others. Clearly, this entails multidisciplinary knowledge demanding the collaboration between researchers/analysts of different fields. Below we provide some guidelines and tips that can be useful to carry out valuation assessments focusing both benefits and costs stemming from PGBs provided by AFS.

With regards to the valuation of PGBs provided by AFS, it is also important to bear in mind **when** they are particularly useful. If we take into account the above-mentioned reasons behind why to value, surely the most relevant from the governance perspective relates to supporting decision-making to design and implement governance mechanisms (GMs) to improve the provision of PGBs by AFS. In this sense, valuation assessments can provide valuable information at different stages of the governance-making process (Villanueva *et al.*, 2017d). For example, demand-side valuation assessments can be useful to set priorities in the agenda-setting stage by delivering estimates of benefits stemmed from the PGBs provided by AFS. Later on, in the policy formulation stage, estimates of benefits will be useful to check whether the implementation of a certain instrument would be expected to yield net gains to the society or not (i.e. approving or not their implementation). In addition, supply-side valuation assessments can be useful in the policy formulation stage by providing timely information with regards to budget requirements to achieve a certain set goal of PGBs provision

⁴ Thus, the same change in the provision of PGBs by AFS might for one person be seen as a loss but for another person as a gain. As can be expected, this represents an important issue when valuing benefits stemmed from such provision and hence should be carefully checked by the analyst if this is happening within her/his target population.

level or provision level to be achieved for a certain budget set beforehand (with both referring to goal-led and budget-led policy-making -see Villanueva *et al.* (2017d)). Therefore, as valuation assessments typically takes time and resources, if they are to be part of the governance-making process, they have to be well-coordinated in order to provide timely and valuable information for policy-makers.

Once we know *why* we value PGBs provided by AFS, have precisely delimited them (i.e. the *what*) and clearly understand *when* the results of the valuation assessments are of special use for policy-makers, next we provide guidelines on **how** to value them from the demand and supply side.

3 Demand-side valuation

Within the PROVIDE project 13 demand-side valuation assessments were made in the same number of CSRs, including surveys with around 2,400 filled-in questionnaires and gathering information regarding a common set of (socioeconomic) variables relevant from the demand-side –including gender, age, and place of residence, etc. Here, we outline the main lessons elicited from these assessments. For more in-depth information on the results obtained from the demand-side, we recommend reading the previous deliverables within WP4 (Villanueva *et al.*, 2017b; Villanueva *et al.*, 2017c; Villanueva *et al.*, 2017d).

3.1 GENERAL GUIDELINES

Here we provide general guidelines to carry out valuation assessments to estimate benefits stemming from the PGBs provided by AFS. These guidelines rely on the experience throughout the PROVIDE Project.

a) Identifying the “problem” to be valued from the demand-side

This mainly entails which PGB/s provided by AFS will be valued and what types of values should be the focus of the valuation. With regards to the system under analysis, it is paramount to clearly identify to what extent it is AFS-wise or area-wise. For the former, this would mean to analyse PGBs provided by just one (or certain) AFS, very likely sharing similar characteristics (thus making it easier for identification by the general public), but also having the risk of analysing scattered systems –which make it more difficult for the general public to clearly recognise the benefits from the PGBs provided (as shown, for example, for the Spanish CSR –see Villanueva *et al.*, 2017c). For the latter, different AFS would likely be found in a certain area under study, thus showing different characteristics which can make the valuation of benefits from the PGBs provided trickier (e.g. as they will be provided at different levels by different AFS in the same area). In both cases, but especially for area-wise systems, the issue to what extent people place the same value on the same PGB provided at a certain level by different AFS is a relevant question, which is yet open for further research.

With regards to the PGBs themselves, as mentioned above, their identification may not always be straightforward, especially in the case of PGBs which are influenced by multiple factors and for which it can be difficult to isolate the role of AFS (e.g. rural vitality). In addition, it is very important that the analyst explores to what extent non-use vs. use values are significant and should therefore be included in the valuation (together with use values), and whether to use of certain methodological approaches (e.g. spatial approaches) over the others (Schaafsma *et al.*, 2013). Finally, as there is usually

a high variety of PGBs provided by AFS, the analyst should typically focus on the most important ones. This may not always be crystal-clear –e.g. different criteria can be used such as gross or net benefits attached, scale to which they are enjoyed, etc. (see Novo *et al.*, 2017a, for a comment on this).

Our experience within the project is that to delimit the problem to be valued, the use of participatory approaches can be especially useful for the adequate selection of the case study (area or AFS) and the most important PGBs provided there. With regards to the participation of stakeholders, we found that mapping information can be of much help for them to better define the areas/AFSs worth of study, and the other way around, i.e. stakeholders' knowledge can be used to refine mapping information (see Komossa *et al.*, 2016). Also, participatory approach can be very useful to characterise other relevant issues with regards to the problem to be valued such as those related to temporal frame (namely, stability and seasonality) and the contextualisation of the provision of PGBs by the AFS under analysis compared to that of other AFS and (close) areas.

b) Identifying the scope of assessment

Once a problem (i.e. a set of main PGBs) is defined as the focus for the assessment, the first step is to identify who benefits from the PGBs under study. Some PGBs may show significant attached values at local scale, whilst others may show significant values at larger scale. This typically relates to the relative importance of use and non-use values over the total economic value attached to the PGB. In this sense, when use values are much higher compared to non-use values, the valuation scope should usually focus on local scale, otherwise it should focus on large scales. Therefore, we recommend the analysts identify the geographical scope of assessment by considering only the scale where the benefits from PGBs provided by AFS can be considered significant, whilst also identifying the role of use and non-use values associated with those benefits. From most of the results of the PROVIDE project, we can underline that sometimes it is not so easy to anticipate low significance of non-use values –thus making it difficult the selection of the adequate scope (Villanueva *et al.*, 2017d). An evident example is biodiversity, for which benefits (mostly use values) enjoyed by local population are visible, while benefits (mostly non-use values) enjoyed elsewhere are much more difficult to be identified. In this sense, it is important to identify the existence of certain well-known endangered species (such as the lynx for the Spanish Hotspot (HS)), as they can entail very large non-use values. However, besides some exceptions such as fighting climate change or cases like the one described, as many of the PGBs provided by AFS are mostly locally consumed, it can be presumed that in most cases the valuation assessment should be carried out at local/regional scale. In this regard, when more than one PGB is valued through the same valuation exercise, the analysts must be aware of potential biases related to the different suitable scope of the PGBs.

c) *Knowing the joint consumption of PGBs*

Relevant joint relationships in the consumption of PGBs considered will often take place (OECD, 2001). These joint consumption processes have to be explored in order to distinguish part-worth values common to different PGBs from others specifically attached to each PGB. Therefore, to elicit robust estimates of the benefits from these PGBs, the analyst should identify whether there is a strong case for the consideration of joint demand issues and, if this is the case, s/he may focus the assessment on the whole set of interrelated PGBs rather than on just one single PGB, so to avoid double counting. In this regard, the use of secondary sources of information is strongly recommended.

d) *Setting the target level/s of provision*

The setting of target level/s is necessary to define the change (improvement) that will be the object of the valuation assessment. Our experience within the project shows that this has a large impact on the final welfare estimates obtained. In this regard, two main decisions have to be taken: the use of indicator/s that adequately reflect/s the provision of the PGB/s analysed, and the definition of the levels, both initial (i.e. current situation) and target, which will reflect the improvements in such provision. We show how both decisions determine the final outcome of willingness to pay (WTP) estimates for various PGBs (see Villanueva *et al.*, 2017c).

With regards to the definition of indicators, all of the demand-side valuation assessments implemented within the project demonstrated this through the estimate of WTP for improved provision of PGBs, such as rural vitality (see Italian and Romanian CSRs), water quality (see Scottish and Austrian CSRs), and recreation and scenery (see Dutch, Finnish, and Bulgarian CSRs), among others. Thus, from the valuation perspective, the use of adequate indicators to represent the levels of provision of PGBs by AFS is vital. For the right selection of indicators, the following criteria can be useful (Bell and Morse, 2008; Roy and Chan, 2011): i) scientific and technical reliability; ii) measurability; iii) relevance (as reflecting the provision of PGBs by AFS); iv) transparency in the calculation; v) policy relevance; vi) sensibility to spatial and temporal changes; vii) possibility of transference; viii) ease-of-use (incl. data availability, cost-effectiveness, etc.). Eventually, the aim is to have a set of indicators that adequately reflect the current and target level of provision of PGBs, allowing for comparability intra- and inter-case.

Also worth mentioning is that, for survey-based valuation methods, as people are usually not familiar with technical information regarding PGB provision, we encourage the use of “equivalent” indicators to provide the same information as shown by technical indicators in a non-technical way which can be more easily understood by members of the general public without requiring expert knowledge. An example of this would be using the number of Olympic stadiums filled by the yearly

aggregate soil losses from the Spanish HS, instead of tons of soil loss per hectare and year. Logically, “equivalent” indicators should be used cautiously, accompanied by suitable explanations and after careful testing, as it may in turn create some bias in the final results of the valuation.

With regards to the definition of levels, also we provide examples of how this can impact WTP estimates (Villanueva *et al.*, 2017c). Several points are worth highlighting here. Firstly, the definition of current level of provision is of utmost importance as this could cause endowment effects (linked to how the status quo (SQ) or business as usual (BAU) alternative is defined) (e.g. see biodiversity for the case of Scottish and Spanish CSRs). Secondly, it is crucial that the target levels are defined within feasible boundaries, ensuring that we are not valuing unattainable levels of provision of PGBs. This may take into account current or envisaged budget allocations to the measures, which could support an easy use for policy evaluation afterwards. In addition to these, the analyst has to be aware that there are several valuation issues which are delicate to handle, such as thresholds effects regarding PGB consumption and, more generally, different utility function-types (together with different joint demand relationships) depending on the PGB considered. In all this, the use of stakeholders –especially for local assessments–, experts, and secondary sources of information are highly recommended before applying any empirical valuation analysis.

e) Selecting and using valuation method (VMs) to assess benefits

To select the most adequate VM, the analyst has to observe to what extent it can be used for the PGBs under assessment and to estimate the relevant values attached to them. In addition, as in any other study, information and resource availabilities have to be taken into consideration, with often the more precise the VM being more time and money consuming. In addition, analysts will have to take account of the specific issues related to the use of a certain VM. For example, for stated preference methods, issues related to the hypothetical valuation situation (such as avoiding hypothetical bias, the selection of the payment vehicle, credibility of scenarios, etc.) (Bateman *et al.*, 2011; Pascual *et al.*, 2011) must be carefully observed when designing the valuation exercises. The reader can find further information on VMs in the following section 3.3.

It is worth emphasising that one of the main issues that the selected method (especially survey-based) has to deal with can be the general public’s lack of knowledge with regards to the PGBs provided by the AFS. This entails a high risk of obtaining biased estimates, which can eventually jeopardise a meaningful support to governance decision-making. Not surprisingly, there is a growing body of literature analysing the influence of information given to respondents on the final estimates obtained (Braga and Starmer, 2005; Barkmann *et al.*, 2008; Glenk and Colombo, 2011, among others). However, to control for the role of information on demand-side valuation assessments was beyond

the research scope and had to be left for future investigation. One of the main points related to this is to find adequate options/methods for the unaware respondents to robustly build their own preferences towards different PGBs or the same PGBs provided by different AFS. In this regard, our results point to the usefulness of actively involving stakeholders in the design of valuation assessments which carefully handle this issue.

Furthermore, given the high heterogeneity of benefits evidenced throughout the project, not only in relation to spatial factors (e.g. see the Dutch case study) but also to socio-cultural factors (highlighted in most of the cases study), it is highly recommended to control for determinants of such benefits (Villanueva *et al.*, 2017b; Villanueva *et al.*, 2017c). In this regard, we coordinated the assessments using common sets of variables which may influence benefits stemming from PGBs provided by AFS (see Villanueva *et al.*, 2017b), including socioeconomic characteristics, as well as those related to lifestyle, and attitudes and opinions (especially towards the PGBs and the AFS under study). In addition to these, we recommend that analysts further explore potential determinants, as we have found that in many cases there are determinants specifically related to each case study. These may be contingent upon specific dynamics of use (e.g. recreational habits) or local facts (e.g. some dramatic events in case of public bads) so are usually local specific and difficult to generalise; as a consequence, local stakeholders can very much contribute to provide information of this type. It is also of relevance to control for people's opinion on property rights, as this influence respondents' point of reference in relation to which they perceive benefits "provided" (i.e. the point of reference in relation to which they are willing to pay for improved provision of PGBs by AFS) (Bromley, 1991), as shown by our results together with previous empirical valuation assessments (Vera-Toscano *et al.*, 2008; Rodríguez-Entrena *et al.*, 2014).

f) Estimating benefits stemming from PGBs provided by AFS

After the implementation of the valuation assessments and subsequent data cleaning, data analysis is carried out. We would like to underline three main points specifically related to demand-side valuation assessments which have to be borne in mind by the analyst. First, it is important to explore whether benefits (demand) stemming from PGBs are better represented using linear or non-linear functions. This will determine the modelling approach, and therefore the final estimates. Second, taking into account that benefits will be heterogeneous, our data analysis should explicitly incorporate estimates on how the main determinants (e.g. spatial or socio-cultural factors) affect them (sign and magnitude of the effect). For some approaches (DCE (Discrete Choice Experiments) for instance) it is especially important to isolate the main factors avoiding (or minimising) multicollinearity and heteroskedasticity effects. Third, as we have identified a variety of biases that may influence results, we strongly advocate for triangulation of the estimates, both by comparing them with other

estimates provided by similar studies (either on the same region or elsewhere) and by comparing the aggregated benefits to policy budgets currently devoted to the PGBs under study or external costs for which estimates are available (the study by Pretty *et al.*, 2005 represent an example of this type).

g) Interpreting results

Demand-side valuation assessments are of special interest for policy-making either to support policy agenda-setting, budget allocation or the design of GMs during the implementation stage (see Villanueva *et al.*, 2017d, where valuation of PGBs provided by AFS is contextualised within the policy-making process). This must focus how we interpret our results, to support governance decision-making. In this sense, stakeholders (especially policy makers and representatives from the civil society) can very much contribute to elicit valuable messages to design GMs promoting a smart provision of PGBs by AFS. To this aim it is very important that interpretation takes into account the way the valuation is built and its level of uncertainty, as well as the potential biases, usually requiring some interaction between the analyst and the policy makers. In this direction, a suitable account of the confidence intervals or analogous metrics should be considered as a good practice in results delivery.

With regards to the interpretation of results and how they feed governance-making concerning PGBs provision by AFS, we recommend reading the outputs from PROVIDE project's Work Package 5 (WP5), which focuses the formulation and evaluation of GMs for delivery PGBs (see Schaller *et al.*, 2017, and forthcoming WP5's documents).

3.2 STAKEHOLDER INVOLVEMENT

As shown in the project, to involve stakeholders in the process of demand-side valuation assessment of PGBs provided by AFS is strongly beneficial to anticipate potential problems with valuation and, eventually, obtain more robust estimates of the benefits stemming from such goods. This has been emphasised in the project's Work Package 2 (WP2) "Innovative co-construction of knowledge – ensuring collaborative research and dissemination" (see Novo *et al.*, 2017a; Novo *et al.*, 2017b, and forthcoming WP2's documents). First and foremost, stakeholders can provide valuable input on the selection and identification of the main AFS and their associated PGBs thereby helping to focus the analysis and ensuring its relevance to the CSR, which is something underlined in previous tasks of the project (Marconi *et al.*, 2016; Novo *et al.*, 2017a). More specifically, we find contributions from the stakeholders particularly useful with regards to:

- Setting current and target levels thereby supporting the definition of the change to be valued. Stakeholders can validate the information gathered by the analyst, especially concerning setting attainable target levels from the perspectives of both the producers (i.e.

feasible practices to be adopted) and policy-makers (i.e. targets consistent with governance implementation).

- Providing information on demand function of PGBs. Here, stakeholders can supply important information on individuals' sensitivity to changes in the provision of PGBs, with special emphasis on the identification of threshold effects on the benefit function of consumption of PGBs (especially with regards to the lowest level of provision for which there is some WTP), temporal frame, and specific dynamics of use (e.g. recreational habits) or local facts (e.g. some dramatic events in case of public bads) which are usually difficult to discover by the analyst.
- Setting up realistic hypothetical markets for valuation (e.g. by advising about the type and format of information to be provided to the respondents), also helping to avoid respondents' potential conflicts (e.g. ethical) with market creation.
- Identifying equivalent indicators which adequately reflect the provision of PGBs.
- Interpreting the results obtained.

There are also some practical lessons that arise from the active participation of stakeholders within the process of implementation of the valuation assessments, relevant to both demand and supply-side approaches. Valuation assessments were discussed in the second and third rounds of PROVIDE stakeholder workshops (at local and EU level); with the former approaching the issue in a more general fashion (e.g. discussing the most relevant from the valuation perspective and how this information feeds the policy-making process) and the former focusing more on in-depth discussions of the main results from the valuation assessments made in each CSR/HS, and their potential comparability and transferability. Before these workshops, a first round of workshops focused on main HSs in each CSR and PGBs provided by their AFS. Among the practical lessons to highlight are the following: firstly, careful selection of stakeholders to ensure a wide variety representing the different groups affected by/benefitting from the PGBs provided by AFS. This includes stakeholders representing not only PGB producers (i.e. farmers and foresters) but also relevant groups from civil society (in particular, ecologists, consumer associations, local associations, etc.), policy-makers (at local, regional, national or higher level, depending on the most relevant scale of consumption of the PGBs under study), and researchers (covering several fields including economics as well as other social and environmental sciences). In this sense, a good representation of policy makers from different directorates (especially agriculture and environment) is also advisable. Secondly, providing stakeholders with prior information on the objectives of the workshops with regards to valuation assessments and the activities to be carried out is highly recommended. This especially relates to the above-mentioned points both general (i.e. selection of main HSs within the region, PGBs mainly provided) and specifically linked to valuation assessments (setting up of indicators to measure PGBs

provision, definition of current and target levels, existence of joint consumption, identification of issues, etc.). To enrich the interpretation of the results obtained, it is important to clearly convey the results (preferably circulating these amongst stakeholders prior to the workshop) and predefine specific questions to be discussed by the stakeholders, otherwise it is easy that the stakeholders get off the point. At the same time, however, space also needs to be allowed for stakeholders to raise additional questions and issues, which researchers may have missed and which can provide additional, important insights. Taking into account the specialised skills required to manage activities (workshops, meetings, etc.) of participatory approach, it would be advisable to count on well-trained professionals specialised in this.

3.3 LESSONS LEARNED FROM A SELECTION OF METHODS

To estimate monetary values of benefits stemming from PGBs provided by AFS we found the stated preference methods, especially, DCE, to be the most adequate approach of those carried out within the PROVIDE project. However, there are other monetary and non-monetary valuation approaches, usually simpler, which can provide further insights adding to these methods, which we have found to be useful in specific situations. In addition, under circumstances of scarce (time and money) resources, the use of benefit transfer, in which values estimated in other locations are applied to the study location (i.e. it consists of a method relying on results obtained from assessments using other valuation methods), can be justified. This is a cheap and convenient method although, as shown in our assessments, there are some issues associated with the transfer of values which must be considered. Below we provide the main insights drawn from our experience with the valuation methods.

3.3.1 Stated preference methods⁵

Our experience within the PROVIDE project is that stated preference methods (DCE and, to a lesser extent, contingent valuation (CV)) can provide accurate estimates (in monetary terms) of benefits stemming from PGBs provided by AFS, both as a whole and as individual PGBs. In addition, these methods –especially DCE– are robustly supported by the economic theory and allow for estimation of trade-offs between different PGBs, which is very convenient as joint consumption may be present. This method has also been shown to be easily adapted to different valuation contexts (different CSRs, HSs, PGBs, etc.). On the downside, they –particularly DCE– require a large amount of resources, including those related to learning quite a technically challenging method, time and money. For instance, we

⁵ Here we do not aim at providing elaborated guidelines on the use of these (and other) methods but to outline specific issues and relevant points arising from the results obtained from the valuation assessments carried out –either here for demand-side or later on for supply-side. For an overview of stated preference methods, we recommend reading Mitchell and Carson (1989), Bateman *et al.* (2002), Hensher *et al.* (2005), Hess and Daly (2014), Johnston *et al.* (2017), among others.

register around 3-4 person-months for the valuation assessments using this type of methods, compared to 0.5-2 person-months for most of the assessments using other VMs. In addition, DCE exercises places a significant cognitive burden on the respondent, which may hamper the estimation of accurate WTP results.

The implementation of this method in several contexts allow us to draw some lessons to be considered in future valuation assessments of benefits stemming from PGBs provided by AFS. The first one relates to the setting up of attributes and, especially, levels. In this type of assessments, some of them will typically relate to PGBs, with different levels of provision being defined in each. For the case of several PGBs, the analyst should anticipate whether there is a high likelihood of joint consumption to be present. If this is the case, this should be incorporated beforehand in the experimental design (e.g. introducing an interaction term between two attributes representing PGBs in the utility function). Also, it is vital to set up attribute levels varying within ranges in the same order of magnitude in terms of expected WTP. This is particularly advisable to minimise the presence of discontinuous preferences, which can lead to sizeable biases, although these can be handled ex-post with the adequate econometric approach (Hensher, 2006; Campbell *et al.*, 2008; Scarpa *et al.*, 2009; Colombo *et al.*, 2013). Also worth noting is that the results obtained from DCE and CV –as for any other survey-based– may be influenced by potential seasonal sensitivity and contingency upon large discussion in the media, which can derived in building strong but unstable respondents' preferences.

Second, there are issues directly connected to this type of methods which deserve a careful consideration by the analyst. Among the issues most frequently encountered within our demand-side valuation assessments using stated preference methods it is worth remarking specific types of biases, such as hypothetical, part-whole, strategic, and anchor effect (Bateman *et al.*, 2002; Bateman *et al.*, 2011). The first one refers to the fact that the respondent acts differently for hypothetical markets than for real markets (Hensher, 2010). An example in our assessments relates to a small group of respondents clearly overstating their WTP for improved provision of PGBs, when in real markets it is likely that they would not pay that much. Part-whole bias is found when the sum of the part values attached to a good exceeds that stated for the whole (Bateman *et al.*, 2002). There are hints that this type of bias is present in a few of our assessments not only with regards to the different PGBs provided by a certain AFS but also with regards to the analysis of specific agricultural sub-systems compared to the whole agricultural system which groups them. We have also found evidence of strategic answers by respondents because they expect that by over/understating their WTP they will influence the final outcomes (and policy implications derived) in accordance to their own interest/opinions. A form of strategic bias detailed in previous reports within this work package is when a PGB producer overstates their WTP based on her/his own interest of hoping to influence budget implications derived and

eventually receive higher compensations for her/his provision of PGBs. In addition, we have also reported anchor effects, where an individual stated WTP is altered (anchored) by the values presented within the survey, related to the valuation design, especially in studies using CV. All these biases can be reduced through using the correct valuation design, especially by introducing specific information to deal with each of them. For example, the use of reminders of the kind “please, provide your sincere response, considering your own income constraints” or information aiming at avoiding part-whole bias would be helpful in this regard. However, as usual a trade-off exists between length of the questionnaire (which also is associated with other biases, especially tiredness) and the presence and intensity of these different biases.

With regards to the above-mentioned biases, within the consortium, there was a general agreement on the higher likelihood of occurrence for online surveys. Whereas they proved to be a faster and less costly way of gathering information on respondents’ preferences than in situ surveys, all the partners have highlighted that there is a lower level of control (especially, on what information they effectively receive and how, and the ensuing understanding) compared to in situ surveys. Additionally, we also found that, in online surveys, respondents tend to take it less seriously than in situ ones, which is something previously highlighted in the literature as well (Carson and Czajkowski, 2014). In this sense, a lesson learned by the partners was the increased need for careful design of an online questionnaire compared to an in-person survey, especially regarding the information on the case study and on the guidance to respond to the valuation questions (e.g. including audios to facilitate respondents’ involvement and obliging the respondent to listen to it before going ahead with the next part of the questionnaire).

Another lesson relates to hiring good and serious panellist companies, as companies used by some partners had delays in gathering the of results and required a close look from the researchers on respondents’ choice patterns (as panellist respondents are usually savvier, which can be a drawback, e.g. due to higher likelihood of using shortcuts—see the Spanish CSR for an specific example Villanueva *et al.* (2017c)). Therefore, unlike some studies which clearly advocate for web-based surveys, especially using CV (e.g. Marta-Pedroso *et al.*, 2007; Nielsen, 2011), our experience suggests that online surveys should be used on the condition that they are short, to the point, include balanced information to generate the hypothetical market and questions to control for systematic biases, and enable the identification of for example strategic and protest responses. All this taking into account that, as mentioned, there is a trade-off between providing more information –to facilitate respondents’ involvement on the exercise– and the accuracy of WTP estimates (Meyerhoff and Glenk, 2015).

3.3.2 Other methods (revealed preferences, multicriteria, etc.)

The use of other valuation methods in addition to stated preference methods by a number of partners within the PROVIDE project has contributed to broaden the picture on demand-side valuation of PGBs provided by AFS. With regards to monetary valuation, revealed preference methods (hedonic pricing) and spatially explicit valuation approaches were used. The latter (see one of the Czech case studies in Villanueva *et al.*, 2017c), provided interesting results on benefit estimates attached to scenery and recreation based on housing markets. As shown in this application, the use of this method can overcome some of the survey-based issues mentioned above for the stated preference methods. On the downside it is usually difficult to plainly separate the value attached to the PGB from other factors (location relative to relevant services –schools, commercial centres, etc.–, type of neighbourhood, etc.) and revealed preferences typically suffer from lack of, or incomplete, information. As regards spatially explicit analysis (see the Dutch case study in Villanueva *et al.*, 2017c), to incorporate spatial dimensions in the valuation of these goods is very pertinent, as it provides relevant insights on potential markets, better identifying “sellers” and “buyers” spatially. The particular assessment carried out shows how benefits derived from the PGBs provided by AFS vary spatially, especially depending on the type of user and service provided, thus providing useful information for policy-makers to set actions to ensure that the benefits expected from the PGB by a certain user are made available to her/him. It is worth noting that the emphasis on spatial analysis may lead to disregard the accurate estimate of benefits, thus in this type of approaches it is necessary to balance spatial and valuation analysis.

With regards to non-monetary valuation, the use of multicriteria analysis stands out, as it provides a diverse approach compared to alternative methods. In the example included within the project (see the Bulgarian case study in Villanueva *et al.*, 2017c), which is based on the Analytic Network Process (ANP) method (Saaty, 2005), it is apparent that it can be helpful to integrate the multiple elements and the abundant interrelationships characterising the joint consumption of PGBs provided by AFS (Renting *et al.*, 2009; van Zanten *et al.*, 2014). This is often not feasible for monetary approaches such as the ones mentioned above. Their results may be of interest especially for initial stages of the research and governance-making process, in particular to select/discard alternatives within it. In any case, the ability of multicriteria analysis is limited in terms of providing more accurate information on the monetary benefits stemming from these goods. It is therefore recommended that multicriteria analysis is used to complement monetary valuation methods. In contrast to more specific valuation method such as DCE or CV, this multicriteria method can be easily used by policy-makers, as it allows the integration of inter-disciplinary issues (which characterise the provision of PGBs by AFS) in a short period of time. In this sense, an interesting way of seizing the advantages of multicriteria and

monetary valuation methods would be to use combinations of them, like the one used in the project (i.e. combination of Analytic Hierarchy Process -AHP- with CV).

3.3.3 Benefit transfer

Our results hint at the potential for value transferability regarding the benefits derived from the PGBs provided by AFS (Colombo *et al.*, 2007; Czajkowski and Ščasný, 2010; Martin-Ortega *et al.*, 2012; Brouwer *et al.*, 2015; Glenk *et al.*, 2015; Johnston *et al.*, 2015). They suggest that there is room for benefit transfer using benefit estimates from a wide range of areas, especially when similar contexts and AFS providers are at stake. Still, several issues are worth pointing out with regards to its use as a VM.

One issue to bear in mind refers to comparability of benefits. Whereas this is often overlooked in value transfer due to the low number of studies available, based on our experience, this topic needs to be addressed upfront in valuation studies. This implies considering explicitly both the economic context and the role of the PGB to be valued with respect to potential determinants (e.g. potential homogeneity of the likely sign of the effects of a factor) and of attributes considered, and their potential interplay. The fact that many valuation studies may be determined by the interaction of multiple goods also hints at the relevance of comparing across cases in which the PGB to be valued has a similar general relevance and/or similar connections with other major PGBs. These considerations may for example mean that it is recommendable to use qualitative means, such as importance scoring, on the policy side to check the profile of PGB perceptions to determine what is actually comparable and what is not.

Another important issue relates to the results obtained from the analysis of determinants. A general remark is that benefits stemming from PGBs provided by AFS are much more context specific than expected beforehand (see Villanueva *et al.*, 2017b). Indeed, the fact that many determinants differently influence the benefits, either inter-HSs or inter-PGBs (i.e. intra-HS), may a priori hamper the transferability of results with regards to determinants of benefits. However, it must be acknowledged that there are certain limitations to the comparison across the results of our valuation assessments (especially referring to the use of different methods and approaches). This result should therefore be treated with caution. In any case, it has to be highlighted that, as generally stated in the stakeholder workshops, and in keeping with the literature, there are some determinants, such as income (Mørkbak *et al.*, 2010) or distance to the production place (Schaafsma *et al.*, 2013), that unavoidably will play a role when transferring estimates of benefits stemming from PGBs provided by AFS. Taking into account the strong influence of determinants on these benefits, the use of function transfer would be preferable.

The above-mentioned issues clearly raise the need for careful use of the (“donor”) studies supporting the benefit transfer assessment. In effect, during the valuation assessments many micro-choices (e.g. the scale of valuation, measurement unit, number of PGBs under study, etc.) have to be made, all of them affecting the final outcome. Therefore, in order to use the benefit estimates of a certain study, the analysts have to deconstruct as much as possible the valuation process used in each “donor” study. This also goes in the direction of identifying a minimum list of information about the valuation process of past studies to ensure the usability for a transfer exercise.

In terms of benefit transfer techniques, these results would generally translate to asserting that function transfer is recommended instead of simple adjusted transfer or even unadjusted transfer. However, the results of our assessments go beyond this, rather hinting at the need to devise clear criteria for upstream phases of the benefit transfer procedure, namely the identification of studies in comparable contexts and the understanding of the bundle of goods under analysis and of their potential interaction.

4 Supply-side valuation

Within the project, 14 supply-side valuation assessments were made, including surveys with more than 2,100 filled-in questionnaires, with most of them gathering information regarding a common set of (socioeconomic) variables relevant from the supply-side (Villanueva *et al.*, 2017c). Here, we outline the main lessons learned from these assessments. Thus, we recommend reading the previous deliverables within WP4 for more in-depth information on the supply-side valuation results (Villanueva *et al.*, 2017b; Villanueva *et al.*, 2017c; Villanueva *et al.*, 2017d).

4.1 GENERAL GUIDELINES

Many of the important questions to be considered when carrying out supply-side valuation assessments have been previously commented in the previous section 3.1 regarding guidelines for demand-side valuation assessments. Therefore, here we will add more specific questions to be taken into account from the supply-side perspective.

a) Identifying the “problem” to be valued from the supply-side

As for demand-side, the problem to be valued relates to (main) PGBs provided by the AFS under study. However, from the perspective of AFS as producer of PGBs, this specifically refers to the extent to which farmers/foresters’ management practices significantly impact society’s welfare by producing PGBs. Thus, if the identification of AFS-wise or area-wise systems under analysis is important from the demand-side perspective, for supply-side valuation assessments it is unavoidable. Only by doing so it is possible to correctly recognise joint production of PGBs (see below), hence allowing us to adequately allocate the costs of provision among the PGBs jointly provided. Here, stakeholders can very much help to identify to what extent the PGBs identified by the analyst are indeed provided at the levels identified as well as the interrelations between different PGBs.

b) Identifying the producers of PGBs

Once a problem (a set of PGBs) is defined as the focus for the assessment, the first step is to identify who produces the PGBs under study, i.e. PGB producers. In the case of the PROVIDE project, producers will typically be farmers and foresters (i.e. land managers running agricultural and forestry activities), although there may also be other rural agents (such as NGOs, tourism-based companies, etc.). The identification of the producers implicitly determines the scope and, to some extent, the unit of analysis (most frequently the farm or forest holding) for the valuation assessments. Also, it is worth taking into account that, as shown in our project, the analyst will face a high heterogeneity of

producers with which s/he will have to cope with, so some prior information –e.g. provided by stakeholders and experts– on this would help for the better identification of main producers of PGBs.

c) Knowing the joint provision of PGBs and private goods

Due to the fact that the monetary costs of provision of PGBs by AFS are highly determined by the type of its joint provision, it is crucial to know the production relationships between PGBs and private goods as well as the current level of provision of PGBs to correctly separate the costs of provision of each PGB. However, unlike for the demand-side, to unambiguously separate values for (costs of provision of) each PGB is a challenging task because the provision of PGBs may be the result of unintended effects of farmer management practices, or there may be win-win situations where costs of improved provision of PGBs are negligible (Marconi *et al.*, 2017; Villanueva *et al.*, 2017c, provide different examples in this sense). To define the reference level from which the change (improvement) in the provision of PGBs is to be promoted it is key to characterise the current level of provision. For this part, the use of stakeholders, especially qualified producers, is strongly recommended, as well as the use of secondary sources of information.

In addition, as with the demand-side valuation, it is vital to use adequate indicators to represent the levels of provision of PGBs by AFS. The above-mentioned criteria for the selection of indicators also applies to the supply-side valuation assessments. It is therefore important to identify a set of indicators that adequately reflect the current level of provision of PGBs across farms/forest holdings, and their future changes promoted by the implementation of GMs. For the supply-side the use of equivalents should be practice-based to facilitate producers' comprehension of the change to be valued. For example, the producer would generally be asked about the costs incurred for the adoption of certain practices associated with an improvement (target level under valuation) in her/his PGB provision compared to the reference level. In the case of results-based payment approaches, the use of these equivalents may sometimes be meaningless, as these approaches are supposed to entail "direct" indicators of farm's environmental and sociocultural performance.

Additionally, if collective/collaborative action is the focus of the valuation, it will be necessary to know how PGBs are provided not only at the scale of the farm/forest holding but also at a larger scale (e.g. groups of farms/forest holdings and/or landscape), to effectively recognise the added effect of this type of action compared to individual-based actions. However, this is often an empirical question, for which scarce information is available.

d) Setting the target level/s of provision

As mentioned above, setting target levels is necessary to define the change (improvement) that will be the object of the valuation assessment. It is important that the target levels are defined within feasible boundaries, ensuring that we are not valuing unattainable levels of provision of PGBs. In this sense, the analyst should avoid defining very stringent target levels as it may elicit rejection or protest responses from the producers (Villanueva *et al.*, 2017a). Also, when setting the target levels, the analyst must be mindful of the practices that the producers have available to achieve improvements in the provision of different PGBs, making sure that no conflicting combination of levels and/or practices is specified as the focus for the valuation. Also, relevant information on the shape of the supply function of PGBs (especially with regards to the occurrence of production thresholds) should be anticipated, as well as on to what extent this function is determined by certain key factors. As before, the use of stakeholders, experts, and secondary sources of information are recommended to define these target levels.

e) Defining a list of governance mechanisms (GMs) that could be a priori used to achieve the target level/s of provision

As we are dealing with public goods, often some actions external to producers would be needed to ensure their improved provision of PGBs (otherwise, as non-market goods, producers would receive no signal to do that). Thus, in the PROVIDE project we implicitly incorporate GMs into the valuation of costs of provision of PGBs. In this regard, the analyst has to explore the available options of GMs that could be used to achieve the target levels. This is required to carry out the supply-side valuation assessment as selection of the GMs very much determines the type of costs to be assessed and their magnitude. For an overview of the available types of GMs identified throughout the project, the reader is referred to Schaller *et al.* (2017) (PROVIDE'S WP5).

As resources are typically limited, it is worth reducing the list of GMs to those that very likely are expected to yield the best results. Obviously, here depending on the governance-making approach, budget- or goal-led (Villanueva *et al.*, 2017d), the way the GMs will be evaluated –as yielding the best results– would vary (e.g. the ones with the highest cost-benefit ratio or the ones most cost-effective). To shorten the list of GMs to those expected to be the best, the use of experts such as policy-makers and specialised researchers would be valuable, alongside a literature review.

In addition, as shown in previous documents within this work package (Villanueva *et al.*, 2017d), it is important to clearly delimit the different monetary costs associated with the improved provision of PGBs by AFS. This includes two broad categories, costs borne by producers and costs borne by the implementing institution. The main monetary costs borne by farmers and foresters include

those related to decision-making, compliance with the requirements included in the mechanism (mostly related to opportunity costs), and private transaction costs (other than those related to decision-making, previously enumerated), while main costs borne by the implementing institution (typically governments) include the costs of design, implementation itself, and monitoring of the mechanism. Depending on the GMs and the target levels of provision, the weight of each type of costs on the total costs to be assessed from the supply-side will differ and, consequently, the focus of the valuation assessment on specific costs or another will differ as well.

f) Selecting and using VMs to assess costs of implementation of each GM

As mentioned, depending on the GM a priori selected for analysis, the relevant costs worth of assessment will vary, and so will the suitable VMs to value them. For example, for incentive-based GMs, i.e. requiring contracting and compensation to farmers/foresters in exchange for the use of certain environmental practices, the use of stated preference methods seems the best fit in many instances, especially because they can capture not only the compliance costs (including opportunity costs) but also private transaction costs. Stated preference methods can be complemented with cost-based methods to assess costs borne by the implementing institution, if these are found to be significant to the study. However, other GMs such as the use of environmental standards typically requires cost-based approaches, as no contract is at play. A full overview of the VMs that best fit each GM is beyond the scope of this study, but it is key that before selecting any VMs the analyst has a clear idea of the main costs associated with the implementation of each GM, which ultimately should be the subject of valuation.

It is also worth mentioning that depending on the VM and the information available on the supply function of PGBs by AFS, the analyst may focus the analysis on measuring farmers/foresters' welfare changes related to discrete changes (from current to target level/s) in the provision of these goods (i.e. costs of implementation for a concrete –point– design of GMs) or to do so for the whole range of possible changes (i.e. estimating a function cost of implementation for each GM). Further information on the selection of VMs is included in the section 4.3.

As in the case of the demand-side, we found very high heterogeneity on costs of provision of PGBs by AFS (Villanueva *et al.*, 2017b; Villanueva *et al.*, 2017c). A common set of variables potentially influencing such costs were included by most of the partners, including farm characteristics and management, and producer characteristics, attitudes and opinions (especially towards the PGBs and governance implementation). Besides these, we recommend the analysts to explore further potential case specific determinants. In addition, as spatial heterogeneity of costs may be relevant, as shown in our project (Komossa *et al.*, 2016), the integration of spatial approach into the valuation assessment

would be of use. All in all, information on heterogeneity of costs is key for better targeted policies, either related to space (different areas and AFS) or PGBs, especially in the direction of reducing rents and increasing efficiency.

g) Estimating costs of PGBs provided by AFS

Many of the above-mentioned issues outlined for the demand-side hold for the supply-side as well, that is, once data cleaning has been carried out, the analyst must look for linearities and non-linearities in the costs function of PGBs provided by AFS, investigate for heterogeneity and, eventually, triangulate the resulting estimates. As mentioned above, connecting cost with easy-to-detect features of farms can yield direct implications for policy design, especially for measures involving few farmers, likely located in a “tail” of the cost distribution. In addition, as joint production is typically present, it is advisable that any statistical analysis controls for correlations among costs functions of different PGBs. However, these effects will often be difficult to isolate. Consequently, it is frequently advisable to focus on practices (which usually affect various PGBs) rather than on PGBs separately.

h) Interpreting results

Typically, supply-side valuation assessments provide valuable information for the design of GMs during the implementation stage. Thus, these assessments are usually very policy-oriented, in the sense that they are intrinsically related to policy design. Therefore, for their interpretation, the involvement of producers and policy-makers can be very helpful. In particular, the former can validate the results obtained as well as explain the heterogeneity by commenting on the significant (and insignificant) determinants of costs. Three particular points sometimes hidden for the analyst are worth underscoring with regards to producers’ contribution to the interpretation of the results. One is that producers can especially help to identify different groups of producers according to their costs (functions) of provision of PGBs. Another relates to the fact that producers can sometimes uncover correlations between variables which have been found to be significant determinants of costs, which are not clear to the analyst. The third point refers to the extent to which the results can reflect costs of provision over time or, in other words, what external (e.g. market trends) and internal factors (e.g. farm structural trends) can affect the validity of estimates over time.

4.2 STAKEHOLDER INVOLVEMENT

As highlighted, stakeholder involvement can very much contribute to supply-side valuation assessments. Apart from the questions (selection and definition of HS and the main PGBs provided) commented on in Section 3.2, our work highlights the usefulness of involving stakeholders in supply-side valuation with regards to:

- Setting current and target levels defining the change to be valued. Stakeholders can validate the information gathered by the analyst, especially concerning setting attainable target levels from the perspectives of both the producers (i.e. feasible practices to be adopted) and policy-makers (i.e. targets consistent with governance implementation). With regards to practices, it is very helpful to invite producers and agronomists as they can better identify what is feasible and what is not. Of particular importance is the recognition of connections among PGBs provision linked to common producers' know-how and expertise, together with local commercialisation context.
- Identifying threshold effects on the cost function of provision of PGBs. Thresholds are common in the provision of PGBs (especially environmental) by AFS, thus stakeholders with extensive knowledge (namely, producers and researchers in experimental sciences) on the AFS under study can more easily identify them.
- Identifying the main costs to be estimated. As the implementation of GMs include different types of private and public costs (see above), the stakeholders (especially producers) can very much help to delimit the main costs that are worth estimating.
- Selecting realistic hypothetical markets for valuation (e.g. by advising about the type and format of information to be provided to the respondents). Unlike for demand, here stakeholders (in particular producers and those closely related to them) can serve to create valuation contexts easily understandable for the respondents (producers), for example by helping to adapt the information provided (language refinement as well as adaptation of the contents –helping to distinguish those relevant from those which are not).
- Identifying equivalent indicators which adequately reflect the provision of PGBs which, in the case of the supply-side especially refers to practices and combinations of them to achieve the target levels set.
- Interpretation of results.

In addition to these, stakeholders (especially producers or those closely related to them) can provide useful input for the identification of other supply-side valuation issues, such as the risk of occurrence of producers' strategic behaviour or protest and "don't know" responses. Indeed, we found that these issues may well derive from more sensitive issues such as moral right or wrong (e.g. for stating their true preferences or, more generally, their opinion on how different types of farming can produce goods and bads). In this sense, our experience points to the fact that producers know each other (and are keen to discuss with each other), which can facilitate the identification of these more sensitive issues. However, a careful selection of participants is paramount to avoid undesired phenomena (e.g. the creation of 'us vs. them' (i.e. producers and the others) identity, which can reduce

the diversity of opinions due to peer pressure). Moreover, a relatively small size of the stakeholder group seems to work well in this regard, as this type of discussion can be difficult to handle with larger groups.

4.3 LESSONS LEARNED FROM A SELECTION OF METHODS

For the estimation of monetary costs of provision of PGBs by AFS the stated preference methods and, especially, DCE were found to represent a highly adequate approach. In addition, there are other monetary valuation approaches which can provide further insights adding to these two methods and which we find to be useful in specific situations. In addition, as for the demand-side, under circumstances of scarce (time and money) resources, the use of benefit transfer can be justified. Below we provide main insights drawn from our results for the valuation methods which stood out, i.e. stated preference methods and other methods, as well as and benefit transfer.

4.3.1 Stated preference methods

As for the demand-side, DCE and, to a lesser extent, CV have proved to be suitable methods to estimate monetary costs of AFS' provision of PGBs. In addition to the advantages named in Section 3.3.1 (including robust theoretical basis and good adaptability to different contexts), in the supply-side contexts stands out its capability for the analysis of trade-offs (between cost of provision of the different PGBs as well as different scheme characteristics), the flexibility to incorporate into the analysis different scenarios of implementation and provide budget-wise information for them (which is of high value for policy-making), as well as to elicit precise estimates of monetary costs (due to the fact that arguably it can include not only direct costs of practice use but also other costs –opportunity and transaction costs– approximated by the producers). However, the same disadvantages outlined for the demand-side valuation assessments (basically, being resource demanding⁶ and imposing a significant cognitive burden on respondents) hold true for the supply-side as well, although in the latter case the cognitive burden imposed may jeopardise the whole assessment, as farmers and foresters usually have lower levels of education and training than the average. As a counterbalance, the fact that these producers are largely used to choosing among policy schemes, based on the compensation offered and the requirements associated with them, can very much reduce the cognitive burden along with several other issues (especially those related to hypothetical and part-whole bias) encountered for demand-side DCE and CV.

⁶ For instance, we register 4-8 person-months for the valuation assessments using this type of methods (with DCE and CV assessments closer to the upper and lower bound, respectively), compared to 0.5-2 person-months for most of the assessments using other VMs.

We in turn find several other issues specifically related to the use of DCE (and CV) to value costs of AFS' provision of PGBs. The first refers to gathering information on producers' current provision of PGBs (i.e. status quo). Although this is key for obtaining reliable results on farmers/foresters' willingness to accept (WTA) to participate in the schemes on offer, this is still not sufficiently acknowledged in the specialised literature using DCE in these contexts (Villanueva *et al.*, 2017a). Therefore, unlike for demand-side DCE/CV, for which individual status quo usually shows minor importance (as can often be assumed to be the same for all the individuals), for supply-side assessments using these methods the producers' status quo must be well-defined individually. Further, as this greatly impacts welfare estimates (Vedel *et al.*, 2015), especially by increasing the likelihood of discontinuous preferences for those cases where the producers actually comply with the requirements of the scheme on offer (Rodríguez-Entrena *et al.*, 2017), the analyst should explore in advance the range of producers' current levels of provision to satisfactorily design attributes and attribute levels.

Related to the issue of individual status quo, strategic behaviour can also be relevant in relation to supply-side DCE/CV, especially if the producer perceives the study as potentially resulting in real-life consequences. In effect, the respondent can show strategic behaviour in several ways, thus not stating their current preferences, especially by overstating the compensation requirements if certain attribute levels very much depart from their own status quo or they perceive that the budget devoted to the scheme can be large (which particularly depend on the payment levels on offer), as well as by under- or overstating such requirements depending on individual's opinions on policy implementation. In this sense, a careful design of the monetary attribute, with balanced levels of payments, is crucial, although further research is needed, maybe following a similar fashion as in the demand-side literature (Hanley *et al.*, 2005; Carlsson and Martinsson, 2007; Mørkbak *et al.*, 2010).

Very much related to the levels of the monetary attribute (especially, the lowest and, more importantly, the highest levels) is the issue with serial non-participation, which can substantially impact WTA estimates (Villanueva *et al.*, 2017a). Compared to demand-side valuation assessments, where serial non-participation may reflect either genuine zero WTP or protest response, for supply-side assessments, it may reflect either very high WTA ("very high takers") or protest response. Our results join specialised literature on WTP contexts (demand-side) (Jorgensen *et al.*, 1999; Meyerhoff and Liebe, 2008; Barrio and Loureiro, 2013; Meyerhoff *et al.*, 2014), by warning of the need for careful handling of these responses in supply-side contexts, especially by distinguishing very high takers and protesters. In particular, we strongly recommend that researchers include follow-up questions to routinely identify protest responses and subsequently excluding them from this type of analysis.

4.3.2 Other methods (costs accounting, expert-based, etc.)

Apart from stated preference methods, the other valuation methods used for supply-side assessments within the project are costs accounting or expert-based. Thus, in the following the main lessons learned with regards to their use are outlined.

Costs accounting, considered as direct costs estimation (which was the option most commonly chosen by the partners), is an easy-to-apply and easy-to-interpret method. Although this method can be applied individually at farm scale, the most usual option is to elicit average costs (for average farms) attached to certain AFS/areas and sub-groups within them. As most partners used the latter option, our comments here relate to this. Taking this into account, this option is also characterised by low resource consumption and quite straightforward implementation. It can provide rough average estimates (especially of opportunity costs) but it is challenging to adequately incorporate heterogeneity in the estimation. Furthermore, the estimation of certain costs, such as transaction costs, can be delicate as well. As a result, it can be very difficult to approximate the compensation needed to encourage producers' participation on GMs using this method. This is supported by the fact that many agri-environmental schemes (AES) suffer from low success partially due to a poor estimation of the required payment levels (which, as guided by EU regulations, should be estimated upon producers' income forgone).

With regards to experts-based valuation methods, while it is an easy-to-apply method with low resource requirements, along with flexibility (e.g. with regards to find relevant information about the different issues at play), it shares with the above-mentioned method the limitations for the quantitative analysis of heterogeneity. With regards to this method, it is worth noting that sometimes it may be difficult to translate expert's knowledge into certain policy relevant (quantitative) information. The selection of experts is key to obtain unbiased information on costs, although it should be kept in mind that sometimes it is hard to distinguish between well-supported and non-well-supported judgements. In any case, expert-based VMs can help to provide a better understanding of the reasons behind heterogeneity in WTA and can help to capture non-monetary costs (e.g. how particular management practices and GMs may be felt to undermine or threaten land managers' identities). Thus, this type of methods can serve as a good starting point to identify the basics for more involved valuation assessments, rather than serving as a stand-alone method.

4.3.3 Benefit transfer

According to our results, benefit transfer in supply-side valuation assessments seems to be less applicable than for the demand-side. This is because the high level of specificity attached to each AFS, as there is different joint production of private and public goods characterising each AFS, resulting

from different biophysical conditions, farming systems, production techniques, and use of practices. In addition, practices that affect the provision of PGBs are often based on detailed differential prescriptions that would be highly different in diverse contexts, and sometimes entailing negligible costs with respect to the overall profitability. All this gives rise to a very high uncertainty, hampering any exercise of results transfer. Consequently, it is very problematic to model all these variables and transfer cost estimates to other cases.

In spite of this, our results suggest that there is room for transferability with respect to determinants of monetary costs of provision of PGBs (Villanueva *et al.*, 2017b). In effect, the general agreement encountered among HSs with regards to the factors significantly determining these costs supports the idea of the existence of certain common determinants in the provision of PGBs by AFS, which has also been highlighted by the literature on this topic (Falconer, 2000; Siebert *et al.*, 2006; Ruto and Garrod, 2009; Uthes and Matzdorf, 2013). In particular, our results hint at some farm structural (such as farm size, farm specialisation, intensification level, and production technique) and producer characteristics (producer age, education level, and farm income), as representing common determinants of costs of provision of PGBs by these systems. Therefore, if an inter-region comparison among estimates of these costs is made, information related to these variables should be taken into account.

In addition, unlike for benefits, cost assessments are usually related to the kind of policy instrument considered. Thus, as stakeholders underlined, policy parameters should also be considered explicitly in the adjustment process, as this may be highly relevant and locally dependent. Given the transcendental importance of determinants of costs, the transferability of determinants among GMs should also be investigated, in order to identify possible issues specifically related to GM implementation. In this regard, although the use of function transfers could occur, it seems that it would be of especial use when the same GM is under assessment.

5 Policy relevant messages

Valuation assessments of PGBs provided by AFS deliver key information (on the related monetary benefits and costs) for policy design. They can especially serve to identify market failures, mainly by providing information on the net benefits (benefits from consumption minus provision costs) in monetary terms related to people's enjoyment of these PGBs, thus helping to recognise areas of special interest (i.e. those with the highest net monetary benefits) for policy action. Also, they can help to prioritise the use of certain GMs over others to correct market failures relating to such PGBs on the basis of their efficiency (net benefit). All these represent valuable information for policy-making, especially for policy formulation, as well as for agenda setting and implementation stages (Villanueva *et al.*, 2017d).

However, this type of assessments is usually financially costly, as well as time and knowledge demanding, typically showing trade-offs between resource needs and precision. Thus, those valuation methods with higher levels of accuracy (e.g. DCE) are also more resource demanding, while those with lower level of accuracy (e.g. experts-based) show lower resource needs. Therefore, a precise estimation of monetary benefits and costs associated with PGBs provided by AFS is often not possible, but there is room to incorporate into the policy making process some kind of valuation derived from precise assessments made elsewhere (i.e. benefit transfer) or from non-monetary approaches. From the policy-makers' point of view, this does not necessarily mean discarding more accurate valuation assessment, but to be aware that different options exist and choose accordingly depending on the available resources (basically, time, money, and knowledge). It seems more likely that policy-makers will select benefit transfer, though –as we have underlined above– this should only be done under the condition that similar PGBs and AFS (from “donors” to the “recipient” study) are at hand, and restricting its use mostly to demand-side valuation assessments. In this regard, on behalf of a smoother and more accurate transferability, our results clearly point to the need for a so-far-lacking common set of indicators to measure the provision of the different PGBs provided by different systems.

With respect to the estimates obtained from the valuation assessments carried out within the PROVIDE project, one of the main policy messages worth highlighting relates the high monetary values attached to the PGBs provided by AFS, evidenced both at EU and local level (see Villanueva *et al.*, 2017c). In effect, we have found a general high intensity of preferences towards a variety of goods and in a wide range of regions, supporting the growing importance of the objective of improved provision of PGBs within the Common Agricultural Policy as well as other policies of this type inside and outside the EU. However, our results also reflect a high heterogeneity of preferences within and across regions, showing numerous determinants (related to respondents' socioeconomic characteristics, and lifestyle,

attitudes, and opinion variables) at play as well. This finding makes a strong case for better governance-making with the objective of ensuring the 'smart' provision of PGBs regionally, which implicitly refers to the provision that can better satisfy spatially heterogeneous social demand. For that objective, regional valuation assessments (especially, AFS-specific) are highly recommended, in particular compared to generic valuation assessments such as those at the EU-level carried out in the project (see Villanueva *et al.*, 2017c).

Another important policy message relates to supply-side valuation results. They indicate that producers are generally able to provide PGBs at viable (frequently low to moderate) costs. However, we also find a high degree of heterogeneity of costs of provision of PGBs, with certain determinants of costs being common to several case studies. The main determinants encountered relate to farm (size, specialisation, intensification level, etc.) and producer characteristics (age, education level, farm income, etc.), with most of them showing a similar effect (i.e. same sign) inter-areas and inter-PGBs. From the valuation perspective, the high level of agreement found for the determinants suggests that transferring information on heterogeneity of costs would not be as unreliable as initially anticipated. From the policy-making perspective, to know the heterogeneity of costs of provision is relevant to help to identify those producers with lower and higher costs, to focus (or not) policy action on them, although further analyses integrating the spatial dimension are needed.

Eventually, another point worth commenting relates to the implementation of GMs requiring much less information from valuation assessments for their design. This especially refers to the use of auctions, as they promote revealing the producer's costs of provision of PGBs. In this sense, of particular interest would be to combine them with results-based approaches, although eventually some kind of prior information on the general costs and benefits at different provision levels would be needed to set some policy parameters (such as budget, prioritisation of bids, etc.). Although additional insights are expected to be shown in the next project's tasks (especially within WP5), this cutting-edge approach is clearly open for further research.

6 Conclusions

The results drawn from a wide variety of cases study and valuation assessments used within the PROVIDE project show the usefulness of systematically incorporating valuation into the governance-making process aimed at promoting the smart provision of PGBs by AFS. Demand-side valuation assessments are of special interest for policy-making as they provide information on the benefits (expressed in monetary terms) that individuals in society enjoy from these goods. This can be used either to support policy agenda-setting (i.e. set the policy priorities) or for the design of GMs during the implementation stage (especially by providing relevant budget information). The importance of supply-side valuation assessments directly relates to the detailed policy design and policy implementation stage, as they can deliver monetary cost estimates associated with the implementation of different GMs and aimed at promoting different levels of provision.

Therefore, we advocate overcoming the usual limitation related to the limited resources of policy makers (time and, to a lesser extent, money) to carry out this type of assessments. Throughout the valuation assessments we provide evidence that there may be options for carrying out valuations at low to moderate costs. However, it is worth noting the trade-off –also identified during the project– between costs and precision of the valuation method. For example, although stated preference methods (especially DCE) yield good results, they are also the most resource demanding. On the contrary, benefit transfer can be a relatively inexpensive way to estimate benefits and costs associated with PGBs provided by AFS, although at the expense of lower levels of accuracy and higher risk of obtaining biased estimates. In any case, our results evidence the need for investigating the heterogeneity of both benefits and costs regardless of the valuation approach selected.

As a result, stronger effort to support this type of assessments is needed, not only to provide more information (in a wider variety of regions, focusing different PGBs, advancing in the identification of determinants, etc.) on benefits and costs of PGBs provided by AFS but also to better develop the valuation methods available to provide more accurate estimates at lower costs, better incorporating spatial, environmental and sociocultural dimensions. Our experience shows that this requires a pragmatic approach in which a higher evaluation effort should be placed in cases characterised by high uncertainty about PGBs values coupled with high relevance of the problem.

However, it is also worth acknowledging that the costs, the limitations and the potential biases of valuation methods suggest that sometimes they cannot be used as straightforward ways to give judgements about policy decisions or policy parameters. This will very much depend on the extent to which the analyst can deal with such limitations and minimise potential biases, so triangulation of the

results obtained with previous results as well as other secondary (e.g. public budget-wise, market-related, etc.) information is essential to confirm that results are robust and can precisely support governance-making. In any case, as this would often be difficult to confirm, valuation results can commonly be used as important evidence component in participatory decision-making processes. In this sense, our experience within the project very much supports the active involvement of stakeholders throughout the valuation process and the use of stakeholders to guide the translation of results into policy prescriptions and implications. In addition, at the same time, given the significant resources usually needed for valuation assessments, governance-making solutions requiring less amount of information from these assessments are worth exploring.

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