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Editorial

Biodiversity, our «natural capital» and essential resource to be preserved for the safeguard of the environment and our health, includes biological diversity and a wide range of living organisms in their various forms and in their respective ecosystems. These are well established definitions but their study still needs to be deepened: in fact, considering that ongoing scientific and in-depth studies require an objective comprehension which, for their importance, require the creation of new monitoring systems, as well as interdisciplinary research and development of strategic policies. Research is always attentive when it comes to the biological diversity of an ecosystem where all populations, whether they are vegetables, animal or microbial ones, do influence each other in order to reach and keep those optimal «holistic» equilibriums representing the peculiarity of a territory. Nonetheless, research is not properly supported by a coherent institutional programme and it is characterized by a complicated spiral of rules and regulations, international Treaties and Conventions: the Convention on Biological Diversity (CBD) of the United Nations, FAO's international Treaty on phytogenetic resources for feeding and agriculture (ITPGRFA), Nagoya Protocol. In Italy, the CBD and the Nagoya Protocol do have the Ministry for the Environment and Protection of the Land and Sea as the competent national contact, whereas Vegetable Genetic Resources for agricultural and food use are supervised by the Ministry for Agricultural, Food and Forestry Policies that has enacted the «National Plan on biodiversity of agricultural interest» (PNBA).

This regulatory division has created and still creates distortion on some thematic competences such as the loss of biodiversity in the livestock sector, due to the progressive replacement of local breeds with cosmopolitan ones that are more productive and suitable for industrial breeding. Even if it is a priority for the interest of our Country that the local breeds do play a role, it would not, in practice, be possible to feed the Italian population through the use of local breeds. Identify them, safeguard them and study them do however, represent cutting-edge research for identifying useful genetic variants and therefore giving value added to breeds. Studying through new technologies the current global challenges, such as the increase of products' qualities, the reduction of the environmental impact and the safeguard of the animal welfare, are some of the concrete opportunities for the preservation of biodiversity. At the same time, this would also represent a realistic perspective for enhancing and rewarding the silent and heroic engagement of the Italian breeders who are increasingly disoriented between trends, markets and regulations.

New emerging scenarios, that have already become extremely urgent, such as the biodiversity of aquatic systems, can contribute to outline the pillars of the new «Blue Growth», a perspective on which the EU is outlining, for its new programming, the need of contamination of the scientific disciplines, in a logic of continuous innovation, thus representing a fundamental contribution for a rational spread of knowledge, at the basis of new forms of economic and social development. In continuity with this, and always on the basis of scientific evidence, the various on-going connections between climate change and intensive management of natural resources have already made water essential for life and biodiversity, by identifying therefore in the ecological perspective, integrated to the valorisation of the eco-system services connected to the sustainable use of water in agriculture, the way for the maintenance of biodiversity and of natural capital, more in general, so as to get an intelligent, sustainable and inclusive growth. In this context, the innovations in the management of forests and urban green, characterized by biodiversity for improving air quality, which cause serious respiratory diseases, seem to be particularly promising. These considerations do outline new needs for knowledge, studies and interdisciplinary scientific in-depth analysis in order to contribute at the planning and resilient management of the interactions between biodiversity and society, with special reference to the value of rural and urban green and to the consequent impact on the human wellness and health. It is just on these aspects that it should be outlined the importance of the Mediterranean food profile and its capacity of fostering health through a wide range and quality of foodstuffs, in addition to an adequate

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intake of all nutrients. The alteration in the nutritional status, due to the shortage or excess in macro and micro nutrients, represents an increasingly serious problem and it may be considered as one of the main determinants of the alarming increase of chronic degenerative diseases.

All aspects, from the impact of feeding on health, to the variability in the consumption of the different foodstuffs and the diversity of who consumes foods, require scientific progress and prevention paths for promoting a rational and aware Biodiversity. In order to get an idea of its real dimension, the estimates released by UNEP 2010 (The United Nations Environment Programme) and the World Bank do point out, for Italy, that the Biodiversity and the eco-systems do provide services for a value exceeding 12% of the GDP. An indicator around which researchers, but also technical and policy makers should discuss, is the role played by the eco-system services in favour of the community, such as the safeguard of flora and fauna, maintenance of biological diversity, sustainable use of its components and the fair and equitable sharing of benefits deriving from the use of the genetic resources.

This special section of the Italian Review of Agricultural Economics hosts a selection of double peer-reviewed papers presented at the XII National Conference on Biodiversity, held in Teramo from 13 to 15 June 2018, within the thematic parallel session «biodiversity and economic impacts».

The analysis on some of the main challenges of Biodiversity opens up the monographic section of the Journal, which gathers topical scientific contributions ranging from the identification of methods for the demarcation of high-nature value areas, including an in-depth analysis about the agricultural systems of Italian regional areas, the use of environmental certification schemes as tool of optimisation in the management of the use of irrigation water as well as the use of rural development that measures the conservation of forests in Nature 2000 areas and an important case study on the environmental value of the ecosystem services related to the irrigated agriculture.

The rigorous methodological approach, which is a common element of all manuscripts, makes the applications and some of the results potentially viable to other similar territorial contexts, with the possibility of transforming scientific evidence in efficient programming and management systems for the protection and safeguard of Biodiversity that including those aspects that are less known and therefore currently neglected.

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Editoriale

La Biodiversità, il nostro «capitale naturale», origine e risorsa essenziale da tutelare per la salvaguardia dell'ambiente e della nostra salute, annovera diversità biologica e varietà di organismi viventi, nelle loro diverse forme e nei rispettivi ecosistemi. Definizioni consolidate, ma ancora di superficiale conoscenza, considerati i continui approfondimenti scientifici necessari per una oggettiva comprensione, tanto da richiedere sempre nuovi strumenti di monitoraggio, interdisciplinarietà delle ricerche e politiche strategiche di valorizzazione, per l'importanza e l'attualità che rivestono. La ricerca, sempre attenta alla diversità biologica di un ecosistema, in cui tutte le popolazioni presenti, vegetali, animali, microbiche, si influenzano reciprocamente per raggiungere e mantenere quegli equilibri «olistici» ottimali che costituiscono la specificità di un territorio, non è adeguatamente sostenuta da una coerente programmazione istituzionale, aggravata dalla spirale sempre più complessa di norme e regolamenti, Trattati e convenzioni internazionali: la Convenzione sulla Biodiversità (CBD) dell'ONU, il Trattato internazionale FAO sulle risorse fitogenetiche per l'alimentazione e l'agricoltura (ITPGRFA), il Protocollo di Nagoya. In Italia, la CBD e il Protocollo di Nagoya hanno come referente nazionale competente il Ministero dell'Ambiente, Tutela del territorio e del mare, mentre le Risorse genetiche vegetali per uso agricolo e alimentare sono sotto la supervisione del Ministero delle Politiche Agricole, Alimentari e Forestali che ha promulgato il «Piano nazionale sulla biodiversità di interesse agricolo» (PNBA).

Questa suddivisione normativa ha determinato e tuttora delimita profonde distorsioni su alcune competenze tematiche. Ad esempio, la perdita di biodiversità nel settore zootecnico, per la progressiva sostituzione delle razze locali con razze cosmopolite, più produttive e idonee ad allevamenti industriali, rappresenta una priorità per l'interesse che rivestono le razze autoctone nel nostro Paese, ma è altrettanto vero che non è ipotizzabile nutrire la popolazione italiana con le razze locali. Caratterizzarle, conservarle e studiarle rappresentano linee di ricerca di frontiera per identificare varianti geniche utili e quindi dare valore aggiunto alle razze che le portano. Studiare con nuove tecnologie le sfide globali che ci attendono, come l'incremento della qualità dei prodotti, la diminuzione dell'impatto ambientale e la tutela del benessere animale, rappresenta una concreta opportunità per la conservazione della biodiversità. Al contempo, costituisce anche una realistica prospettiva per valorizzare e premiare il silenzioso ed eroico impegno degli allevatori italiani, sempre più disorientati tra mode, mercati e norme.

Nuovi scenari emergenti, divenuti già di estrema attualità, come la biodiversità dei sistemi acquatici, possono contribuire a delineare i pilastri della nuova *Blue Growth*, prospettiva su cui l'Unione Europea tratteggia per la nuova programmazione comunitaria, in una logica di innovazione continua, la necessità di quell'indispensabile contaminazione delle discipline scientifiche, apporto fondamentale per una razionale diffusione delle conoscenze, alla base di nuove forme di sviluppo economico e sociale. Ed in continuità, sempre e solo sulle evidenze scientifiche, le molteplici relazioni in atto tra cambiamento climatico e gestione intensiva delle risorse naturali, hanno già reso l'acqua essenziale per la vita e la biodiversità, individuando nella prospettiva ecologica integrata alla valorizzazione dei servizi ecosistemici connessi all'uso sostenibile dell'acqua in agricoltura, la via per la conservazione della biodiversità e del capitale naturale in generale, nell'ottica di una crescita intelligente, sostenibile e inclusiva. In questa direzione si confermano promettenti le innovazioni nella gestione delle foreste e del verde urbano all'insegna della biodiversità per migliorare la qualità dell'aria, responsabile di gravi malattie dell'apparato respiratorio. Considerazioni che delineano nuovi fabbisogni di conoscenza, analisi e approfondimenti scientifici transdisciplinari, per contribuire alla progettazione e gestione resiliente delle interazioni tra biodiversità e società, con speciale riferimento al valore del verde rurale ed urbano e al conseguente impatto sul benessere e sulla salute umana. In proposito, va anche evidenziata l'importanza del profilo alimentare mediterraneo e della sua capacità di promuovere la salute attraverso un'ampia varietà e qualità di alimenti, oltre all'assunzione di quantità adeguate di tutti i nutrienti. L'alterazione dello

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stato di nutrizione dovuto a carenza o eccesso in macro e micronutrienti, è un problema in rapida evoluzione e può rappresentare uno dei principali determinanti del preoccupante aumento delle malattie cronico degenerative. Dall'impatto dell'alimentazione sulla salute, alla variabilità nei consumi dei diversi alimenti, ma anche la diversità di chi consuma gli alimenti, tutti aspetti che richiedono progresso scientifico e vie di prevenzione, per promuovere una razionale e consapevole Biodiversità. E per contribuire a favorire una sua dimensione reale, dalle stime del 2010 di UNEP (Programma delle nazioni unite per l'ambiente) e della Banca Mondiale, per l'Italia emerge che la Biodiversità e gli ecosistemi forniscono servizi per un valore del 12% in più del PIL. Un indicatore su cui dovrebbero confrontarsi non solo i ricercatori, ma anche i decisori tecnici e politici per la rilevanza che rivestono i servizi ecosistemici a favore della collettività, come la tutela della flora e della fauna, la conservazione della diversità biologica, l'uso sostenibile delle sue componenti e la giusta ed equa condivisione dei benefici derivanti dall'utilizzo delle risorse genetiche.

Questa sezione speciale dell'*Italian Review of Agricutural Economics* (REA) raccoglie una selezione di articoli sottoposti ad un doppio processo di «peer review» presentati nella sessione tematica «biodiversità e impatti economici» della XII Conferenza nazionale sulla biodiversità, tenutasi presso l'Università di Teramo dal 15 al 18 giugno 2018.

Questa breve analisi su alcune grandi sfide della Biodiversità apre la sezione monografia della Rivista. I contributi scientifici di attualità spaziano dall'individuazione di metodologie per la demarcazione delle aree di elevato valore naturalistico, incluso un approfondimento sui sistemi agricoli di tali aree in Italia, all'uso di schemi di certificazione ambientale come strumento di ottimizzazione della gestione dell'uso di acqua irrigua, all'utilizzo delle misure di sviluppo rurale per la conservazione forestale nelle aree Natura 2000, per terminare con un importante caso studio sul valore ambientale dei servizi ecosistemici legati all'agricoltura irrigua.

La rigorosa impostazione metodologica, comune a tutti i manoscritti, rende le applicazioni ed alcuni dei risultati potenzialmente estendibili ad altri analoghi contesti territoriali, con la possibilità di trasformare le evidenze scientifiche in efficaci sistemi di programmazione e gestione per la salvaguardia e la tutela della Biodiversità, sia pure per quegli aspetti meno conosciuti e di conseguenza attualmente trascurati.

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Introduction

World's Bioversity for food and agriculture

Mario Marino

Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture

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«Over recent decades, the importance of biodiversity to food security and nutrition, rural and coastal livelihoods and sustainable development more generally has gradually been acquiring greater recognition on international agendas.»

On 22 February 2019, at FAO was launched the first report on «The State of the World's Biodiversity for Food and Agriculture». It provides a comprehensive picture of the state and use of this biodiversity, thus providing a strong foundation for the design of effective interventions towards more sustainable, resilient food systems:

Biodiversity at genetic, species and ecosystem levels helps address the challenges posed by diverse and changing environmental conditions and socio-economic circumstances. Diversifying production systems, for example by using multiple species, breeds or varieties, integrating the use of crop, livestock, forest and aquatic biodiversity, or promoting habitat diversity in the local landscape or seascape, helps to promote resilience, improve livelihoods and support food security and nutrition.

1. CLIMATE CHANGE BRINGS NEW AND ENHANCED DEMAND F OR ALL GENETIC RESOURCES FOR FOOD AND AGRICULTURE.

Crop diversity, food security and climate change are closely linked in diverse and complex ways. In fact, we are facing a multi-faceted challenge requiring us to counter the loss of crop diversity and use crop diversity more effectively to achieve and maintain food security in the growing pressures of climate change. Agricultural crop varieties and the particular traits they contain form the very base of our food security. In this sense, crop diversity is a pre-condition for food security, so the challenge of food security cannot be met if crop diversity is not conserved.

New plant breeding strategies will therefore have to aim at improving economic and environmental sustainability by developing crop varieties that produce higher yields with less use of inputs, particularly those industrial in origin. All of this will place increased demands on the availability of a wide range of crop genetic material.

While climate change is one of the drivers of crop diversity loss, it is also an important reason to conserve agricultural crop varieties, exchange them and use them in a sustainable way.

But there is urgency to act: whereas climate change is occurring at a fast pace, the process for breeding a new crop variety may take from 7 to 15 years.

That is why traditional varieties in agriculture are important as a resource that can respond to imminent as well as unknown future challenges.

Therefore, traditional varieties form a reservoir of particular characteristics that may prove useful for the breeding of new varieties in terms of productivity, pest resistance, drought tolerance and other desirable traits. Meeting new and unexpected challenges will require increased and continuing exchange of crop genetic material for agricultural research and breeding.

2. IMPACTS AND IMPLICATIONS OF CLIMATE CHANGE FOR PLANT GENETIC RESOURCES

Although farmers have always adapted their cropping systems to adverse climatic and environmental conditions, the speed and complexity of current climate change poses problems of a new magnitude. Adapting crop varieties to local ecological conditions can reduce risk due to climate change, but the need for adapted germplasm is urgent and requires characterization, evaluation and the availability of materials now housed in gene-banks. The effort to breed for traits valued both today and for the future is likely to increase the general demand for PGRFA. Demand is also likely to increase for genetic resources of crop wild relatives. These genetic resources are being used to address both biotic and abiotic constraints. While demand for such genetic resources is global, their natural distribution is restricted to the centres of origin of crops, often specific sub-regions within continents.

That is why Agricultural development strategies which promote on-farm and in situ conservation are a dynamic form that provides a variety of germplasm options for farmers.

The International Treaty on Plant Genetic Resources for Food and Agriculture greatly promotes the conservation and utilization of plant genetic resources through a series of measures such as follow:

2.1. The Farmers: custodians of biodiversity

Farmers and other *in situ* custodians of local crop diversity play a critical role in the sustainable use of PGRFA for food, nutrition and economic security and provide a fundamental service to humanity. Diversity in plant genetic resources for food and agriculture (PGRFA) is essential to sustain food, nutrition and economic security. To sustain this diversity, farmers and other crop maintainers that wish to diversify their own crops require an appropriate enabling environment, and adequate conservation management measures need to be implemented *in situ* (in protected areas and other natural or semi-natural sites) and in *ex situ* facilities.

Local crop varieties – also known as landraces or farmers' varieties – can be essential to the food, nutrition and economic security of many people – particularly smallholder farmers and farming communities in rural and marginal areas. The diversity in these varieties can provide insurance against crop failure and wide cropping windows, while the crop produce may be central to traditional local cuisine and specific dietary requirements. Furthermore, these diverse varieties are an important source of locally adapted genes for the improvement of other crops.

Despite the wide recognition of the importance of local crop varieties and the role of farmers and other crop maintainers in sustaining them, the enabling environment to advocate their continued cultivation has been eroded, partly due to the promotion and widespread adoption of high yielding uniform varieties. Many diverse local varieties have therefore been lost along with the knowledge associated with their cultivation and use.

Some relevant experiences have been made by the Community seed banks (CSBs), commonly established and managed by farming communities in collaboration with agro-NGOs or research institutes. In some countries, they may be associated with hobbyists or other communities, such as gardeners with an interest in heritage varieties. CSBs have been established in many countries to safeguard local crop varieties and to secure the seed supply for local communities. CSBs are important for local food security and empowerment of local communities, as well as for maintaining traditional knowledge and raising awareness of the value of local crop diversity.

2.2. The value of smallholder farmers

Supporting farmers in the creation of smallholder seed enterprises (SSEs) can lead to the stable production of quality seeds of local crop varieties, as well as improved livelihoods through increased income and diversification of farmers' activities. It is urgent to recognize and integrate 'informal' and 'formal' seed systems, as well as the public and private sectors, and promote entrepreneurship, private sector development, and the creation of new or strengthened markets for seeds and local crop produce.

The immense value of local crop diversity is not always fully understood or appreciated by the general public, policy-makers, local communities, and even by farmers and other crop maintainers. Inventories provide the baseline information needed to understand the local crop diversity that exists and the array of associated social, economic, geographic and environmental data. Increasing awareness of the value of local crops amongst farmers, communities, businesses, policy-makers and the public at large is an important ingredient in efforts to sustain crop diversity. Options include the establishment of farmers' associations and networks through which information and planting materials can be shared, the organization of diversity fairs, and the use of media (radio, television, popular press and the Internet) to promote local diversity and highlight special events.

3. CONCLUSIONS

The 40th Session of FAO Conference welcomed FAO's initiative to act as Biodiversity Mainstreaming Platform and requested FAO to facilitate, in collaboration with its partners, actions for the conservation, sustainable use, management and restoration of biological diversity across agricultural sectors at national, regional and international levels

It is still urgent to take concrete steps to meet the2030 Sustainable Development Goals. The broader the genetic base we can rely on, the better equipped we are to adapt to changing climate conditions and to provide global food security.

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Evaluation of ecosystem services of irrigated agriculture: a policy option for a sustainable water management

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Abstract. Irrigated agriculture can generate pressures on water bodies and, consequently, potential environmental costs; likewise, agricultural water use can provide several ecosystem services (ES). Both pressures and benefits must be included in the economic analysis of River Basin District Management Plans (RBDMPs), for the environmental cost accounting of agricultural water use. In the RBDMPs, the main reference for environmental benefits and costs accounting is the Program of Measures (PoM), as set by the Water Framework Directive (WFD). This paper aims to provide a review of the main ES of irrigated agro-ecosystem and to clarify how the implementation of the actions that support them can constitute an opportunity to internalize the environmental cost charged to agricultural sector.

Keywords: agricultural water use, ecosystem services, water management, programmes of measures, River Basin District Management Plans.
JEL codes: Q15, Q25, Q56, Q57.

INTRODUCTION

At international level, agriculture is one of the largest users of water globally; among OECD countries, it accounts over 40% of freshwater withdrawals (OECD, 2018) generating pressures on water bodies both due to withdrawals and to the release of pollutants (IEEP, 2000). These pressures can determine environmental costs, which, according to the polluter/user pay principle (PPP), must be borne by the agriculture sector.

Nevertheless, the use of water in agriculture can generate positive impacts on environment (Rogers *et al.*, 1998; IEEP, 2000; Marsden Jacob Associates, 2003; Dwyer *et al.*, 2006; Zucaro, 2014). In fact, water, as an asset of Natural Capital, does generate several ecosystem services, ensuring the production of food, energy and many industrial products and other goods and services, as well as the integrity of ecosystems supplying habitat for all living beings, including humans.

During the last decades, EU water policy, starting for the introduction of the Water Framework Directive (WFD) 2000/60, introduced a policy based

on an integrated and ecosystem-based approach to water resource planning and management. The Water Framework Directive (WFD) sets qualitative and quantitative water protection objectives, promoting the application of economic principles, methods and instruments for supporting the achievement of these objectives.

Starting from 2015, with the approval of the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) by the United Nations, it was recognized the unsustainability of a development model based only on the environmental level, and it was introduced an integrated vision of the various dimensions of development, based also on economic and social level (United Nation, 2015).

The WFD anticipated those principles, considering water resources as inputs of production process; in particular, through the economic instruments introduced by the Article 9 related to the polluter/user pay principle (PPP) and the full cost recovery, the legislation requires that the environmental objectives are achievable also through an adequate pricing policy able to take into account the effects in terms of environmental, economic and social sustainability. In this context, the principle of adequacy of cost coverage is combined with the objective of an efficient use of the resource with simultaneous reduction of pressures on natural resources.

The territorial reference for the implementation of the WFD are the River Basin District (RBD) and the water planning competences are responsibility of the River Basin District Authorities (RBDA). For water planning process, the Authorities, in accordance with Article 5 of WFD, must carry out an economic analysis considering all water uses and referred to each River Basin District, ensuring consistency across the DPSIR chain (Drivers-Pressures-State-Impacts-Responses). Through the economic analysis the objectives achievable in each planning cycle and the relative costs (financial, environmental and resource) are identified; in addition, the Programmes of Measures (PoM) associated to the River Basin District Management Plans (RBDMPs) and the environmental benefits produced are identified too. This means that, for all the activities that use water and/or impact on the state of the water and that could prevent the achievement of the environmental objectives set by the WFD, RBDA must identify pressures and impacts analysis.

The Programme of Measures (PoM) is the key tool for the implementation of the WFD, as it is designed to enable the Member States to respond appropriately to the relevant pressures identified at RBD level during the pressures and impacts analysis, with the objective of enabling the environmental objectives at river basin or water body level.

In Italy, the Ministerial Decree n. 39 of February 24th, 2015 issued by the Ministry of Environment establishes criteria to determine environmental and resource costs resulting from different water uses. Following the approach of the WFD CIS Drafting Group ECO2, the Guidelines of the Ministry of Environment establish how to estimate the environmental costs generated by water uses, starting from the pressures and impacts analysis of the economic analysis. In fact, the starting point is to identify pressures and impacts on water bodies generated by activities and, consequently, to identify measures to restore the target state of water bodies. It is necessary to find the combination of measures that give the best result in terms of effectiveness at the lowest price, guaranteeing, at the same time, socio-economic sustainability and economic-financial balance. For this reason, the measures to be included in the PoM should be evaluated through a Cost-Effectiveness analysis that provides a ranking of alternative measures based on their costs and effectiveness. Once the PoM has been established, the total cost of the measures represents the environmental cost generated by water uses, as it corresponds to the cost to be incurred for the removal or reduction of the damage generated by the activities. Subsequently, the portion of coverage of this cost must be attributed to each sector that uses water based on the information acquired from the economic analysis, in order to respect the polluter/use pay principle.

Each Programme of Measures shall include basic measure and, where necessary, supplementary measures. Basic measures are the minimum requirements to be complied with; supplementary measures are the measures designed and implemented in addition to the basic measures in order to provide for additional protection or improvement of water resources. If the measures are implemented and the related cost is sustained, resulting offset in the user accounting, the environmental cost can be considered internalized, so they do not configurate anymore as negative externalities. In this case, it is necessary to identify them and make them explicit in the economic analysis.

In this contest, ecosystem services are also mentioned by the Ministerial Decree 39/2015, and when they are configured as environmental benefits and it is possible to demonstrate the existence of relationships between environmental resources, economic systems and governance, they can be evaluated from an economic point of view and considered in the economic analysis.

This paper tries to answer the following questions: which are the ecosystem services associated to irrigation and how to include ecosystem services of irrigated agriculture in the economic analysis of the River Basin Dis-

trict Management Plans (RBDMPs) to include, in addition with pressures and negative impacts, also positive impacts and environmental benefits generated by water use for agriculture.

1. ECOSYSTEM SERVICES ASSOCIATED TO AGRICULTURAL WATER USE

Water is an asset of the Natural Capital, representing a key component in generating ecosystem services, defined as the benefits people obtain from ecosystems. Natural capital can be defined as the world's stocks of natural assets, which include geology, soil, air, water and all living things. The interaction of Natural Capital assets within of ecosystems generates the flows of ecosystem services, defined as the direct and indirect contributions of ecosystems to human well-being. According to the CICES Classification (Common International Classification of Ecosystem Services) the following types of ecosystem services can be distinguished:

- provisioning services: nutritional, non-nutritional material and energetic outputs from living systems, abiotic output;
- regulation and maintenance services: all the ways in which living organisms can mediate or moderate the ambient environment that affects human health, safety or comfort, together with abiotic equivalents;
- cultural services: non-material, and normally non-rival and non-consumptive, outputs.

CICES does not include supporting services that are ecosystem services necessary for the maintenance of all other ecosystem services. Differently from other ecosystem services classification, CICES provides a classification of potential final services. It is up to the user to decide whether in an application context, the service is to be regarded as final or not.

The interaction between the socio-economic system and the environmental system may also have the opposite direction. In fact, human activities may create pressure on the environmental system generating possible impacts on the conservation status of the Natural Capital. Policies play a key role in this context, as those not oriented towards sustainability may accentuate negative impacts; on the contrary, policies aimed at maintaining Natural Capital can limit negative impacts and ensure the generation of the flow of ecosystem services.

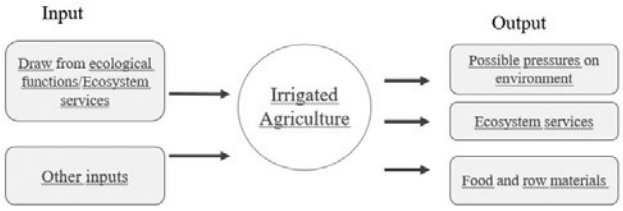
Water, as an asset of Natural Capital, generate several ecosystem services, ensuring the production of food, energy and many industrial products and other goods and services, as well as the integrity of ecosystems supplying habitat for all living beings, including humans.

Like other economic activities, agriculture uses ecosystem services of the surrounding area, generating pressure on environment. Inefficient withdrawals and utilization of water resource for agricultural purposes can have an impact on aquatic ecosystem quality and quantity, generating an environmental cost. Irrigation resource management is fundamental in determining the efficiency of water use. In this context, the Italian case has specific characteristics due to the presence of Reclamation and Irrigation Consortia, which manage collective irrigation. This type of irrigation ensures a higher degree of efficiency than self-supply irrigation, as the Consortia generally organize the distribution through irrigation exercises, management practice that is set, considering the different user requirements, both with regards to the crop requirements, and the specific moment of the intervention in the individual lands.

Nevertheless, agriculture can generate positive effects on the environment while using water. The relationship between irrigated agriculture and ecosystem services is represented in Figure 1: on one hand agricultural production processes use ecosystem services generated by the surrounding area, on the other hand agriculture, in sustainable management conditions, can provide ecosystem services to the society. Irrigated agroecosystems, as they are characterized by infrastructures and practices aimed at the use of water for agricultural production, generate benefits on the surrounding territory, at the level of Ecological Functional Unit (EFU) (Santolini, Morri, 2017), defined as the eco-geographic area characterized by the recognisability of the flow direction of the ecosystem services. The perimeter of an EFU allows to identify the place where the function is developed, in which the performance of the service can be evaluated and the places where the benefits can be appreciated. Therefore, the human activities in irrigation and drainage purpose have enabled the coexistence and interaction between water, vegetation and biodiversity, creating ecosystems capable of generating benefits on collectivity. Often these benefits are supplied in the form of positive externalities, as their value is not included in the company's costs and revenues system. In other cases, the supply of ecosystem services through the interaction of the Natural Capital assets is guaranteed through actions implemented with environmental purposes, attributable to water users in agriculture directly or indirectly. In this context Irrigation and Reclamation Consortia play a key role, as they are responsible for maintaining the territory.

Irrigated agriculture can provide provisioning, regulation and maintenance services and cultural services (Tab. 1). As it shown, ecosystem services are generated

Fig. 1. Relationship between irrigated agriculture and environment.



Source: our elaboration.

through some elements of irrigated agroecosystem, such as hydraulic-agriculture arrangements including ditches, wetlands, riparian vegetation and from irrigation practice. Infrastructures aimed at transporting water for crop irrigation have led to the creation of artificial water bodies capable of generating ecosystem services similar to those generated by natural water bodies. Proof of this is the inclusion of the objectives of protection and improvement of the artificial water bodies and strongly modified between the environmental objectives established by the WFD. Moreover, as mentioned above, the m.d. 39/2015 of the Ministry of Environment recognizes that some reconstructed aquatic systems are capable of performing functions that are configured as ecosystem services. The following paragraphs describe the main ecosystem services generated by the agro-irrigated ecosystem.

1.1. Habitat for species

Irrigated agro ecosystem provides habitats for plant and animal species through its artificial aquatic ecosystems, such as agricultural drainage ditches. Although these anthropogenic systems are habitats of lower quality than larger and more stable water bodies (such as rivers and lakes), in a context of a hyper exploited landscape where natural systems are rare, they may serve as complementary habitats (Herzon, Helenius, 2007; Rolke *et al.*, 2018). In many cases, irrigation canals host several communities of invertebrates (Verdonschot *et al.*, 2011; Hill *et al.*, 2016) fish and amphibians (Piha *et al.*, 2007; Romano *et al.*, 2014; Aspe *et al.*, 2016), birds (Fasola, 1986; Pomares *et al.*, 2015) and mammals (Defra, 2002).

Similarly, wetlands generated through historical water transfers and artificial basins in drought regions are recognized as suitable habitat for several species. A particular case of wetland is rice landscape that hosts many species of water birds. The rice fields are configured as temporary aquatic systems, flooded during the summer and kept dry during the winter, thus following an inverse cycle with respect to the natural wetlands. Therefore, they play an important role in replacing wetlands, particularly in drought periods (Fasola *et al.*, 1996). In some cases, such as in Italy, rice-paddies are recognized as Special Protected Zones areas of Natura 2000. The considerable amount of water used for submerging requires the presence of an irrigation network managed by the Reclamation and Irrigation Consortia, which becomes part of this cultivation system.

1.2. Aquifer recharge

High water consuming irrigation methods, such as submersion and sliding allow the return flows to the aquifer through deep percolation, enabling downstream uses. Several studies demonstrate that reduction of water application at the field scale does not necessarily imply total water savings (Ahmad *et al.*, 2007; Ward *et al.*, 2008).

Moreover, conveyance losses from uncoated canals can provide positive effect if they are «beneficial'losses», namely losses that are re-used or recycled to other beneficial uses either downstream of the water-supply system or within the water-supply system (Marsden Jacob Associates, 2003).

In addition to downstream uses, aquifer recharge service supports groundwater dependent ecosystems (GDEs) include aquifers, caves, lakes, wetlands, ecosystems of coastal lagoons where groundwater flow is needful for dilution of salinity etc. In the North of Italy, the

Tab. 1. Ecosystem services of irrigated agro-ecosystem.

Ecosystem service	Source	Classification
Provision of habitats	Ditches, riparian vegetation, wetlands, paddies	Regulation and maintenance
Water purification	Riparian vegetation, wetlands	Regulation and maintenance
Run-off control	Hydraulic arrangements	Regulation and maintenance
Aquifer recharge	Uncoated irrigation ditches, irrigation	Regulation and maintenance, provisioning
Landscape amenity and Recreation	Ditches, wetlands, irrigation	Cultural
Crop production and food chains maintenance	Irrigation for soil fertility improve	Provisioning, Cultural

Source: our elaboration.

issue of aquifer status is also related to the springs in the area of «Risorgive belt». These springs are important for their ecological function and landscape value (Bischetti *et al.*, 2012; Zucaro, Corapi, 2009). Their recharge is strictly dependent on the interrelation between surface and underground water circulation and from losses from uncoated canals and sliding and submersion irrigation (Gandolfi, 2017).

1.3. Water purification

Irrigation ditches and wetlands can also provide water purification service through aquatic and riparian vegetation that absorbs and reduces nutrients loads from diffuse and point sources water pollution. Several studies demonstrate that vegetated canals mitigate excess nitrogen (Pierobon *et al.*, 2012; Castaldelli *et al.*, 2015). This can occur through uptake and assimilation by plants and microbes, and through denitrification processes, removing permanently nitrogen (Balestrini *et al.*, 2004). Aquatic and riparian vegetation decelerates the flow and promote the sedimentation and the formation of an organic elective substrate for nitrogen reduction processes (Soana *et al.*, 2012). Macrophytes increases the contribution of organic carbon and nitrate to the denitrifying bacteria, creating the ideal setting for denitrification. Riparian vegetation acts as buffer systems between terrestrial human activities and aquatic ecosystems, removing water pollutants from surface runoff before getting into the water bodies (Webber, 2007).

1.4. Cultural and recreative service, hydraulic safety

Ecosystem services described in the previous are benefits provided to the collectivity indirectly. Irrigated agro-ecosystems generate also positive effects, such as cultural services and hydraulic safety, available from the community directly. Irrigation canals are capable of dispose of rainwater and fulfilling the function of maintaining the hydraulic security of residential areas and infrastructure. Moreover, the diversions from rivers for agricultural purposes have modelled the territory creating the typical landscape of irrigated agriculture. The ancient origin of canals and artefacts contribute to make these landscapes part of the cultural heritage of peoples. Irrigated agro-ecosystem has also a recreative function. The landscape of ditches and artificial basins, characterized by mirrors of water, vegetation and monuments, incentive for recreational use from the collectivity, also thanks to the hydraulic maintenance that improves the usability of the territory (Zucaro, 2014). Recreative activities in irrigated landscape include guided tours, fishing, birdwatching, cycling etc. Surrounding areas of ditches and artificial lakes are equipped with picnic areas, playgrounds, cycle-pedestrian paths (Costantini, Romano, 2010). A further socio-cultural benefit is represented by the quality of food production, generating also a provisioning ecosystem service. Irrigation has enabled the modern agri-food supply chain to achieve the high quality level that characterizes the Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) and Traditional Speciality Guaranteed (TSG) products, otherwise not reachable if there was the need to use the foreign raw materials. Without irrigation, the quality level of production through other ways would be more expensive. These higher costs would be dumped on prices, with negative social consequences.

1.5. An example: Restoring and maintaining irrigated agro-ecosystems

The provision of ecosystem services through irrigated landscape requires the implementation of some actions aimed to maintain or restore the anthropogenic systems to ensure the flow of ecosystem services generated from the interaction between water, vegetation and soil. In fact, not every artificial systems of irrigated agriculture is capable of generating ecosystem services. A concrete lined ditch without vegetation cannot represent a biodiversity hotspot and within it, the water purification processes do not occur, neither water infiltration for aquifer recharge.

In addition, without an integrated approach, some processes can produce negative effects. For example, the water infiltration through deep percolation from ditches and fields can compromise status of groundwater if the quality of water infiltrated is poor. In this context, the role of territory management is crucial through the implementation of measure for water resources protection.

In Italy, irrigation Consortia, local water authorities in charge of managing and maintaining the irrigation network and the provision of irrigation water, play a key role in implementing these measures, through their financial resources including contributions of the farmers. Examples of measures are cleaning and resetting activities of irrigation canals beds; restoration and renaturation of irrigation canals in a state of degradation with river bed resurfacing, bank coverings with naturalistic engineering, measures to contrast the rising of the salt wedge, construction of fish ladders, measures to support aquifer recharge processes, phyto-purification, water bodies monitoring, measures for efficiency, improving including price policies etc. Also, compli-

ance with legislative obligations such as the ecological flow release can be considered appropriate measures to achieve the environmental objectives of the WFD. In addition, sustainable agriculture is fundamental to ensure water quality and the flow of ecosystem services. In this context the compliance with obligation of the EU directives on water pollutants and the good agricultural practices promoted by the Community Agricultural Policy (CAP) are suitable measures for water quality protection. The compliance of these measures with the WFD environmental goals allows to consider their economic value in the economic analysis of water uses.

2. ECOSYSTEM SERVICES OF IRRIGATED AGRICULTURE EVALUATION METHODS

As mentioned above, ecosystem services of irrigated agro-ecosystems are often generated in the form of positive externalities, as the interaction between irrigation activity and environmentcauses a change in the human well-being without producing revenues for farmers or water distributors.

The ecosystem services generated by the irrigation agro-ecosystem are externalities, since these are benefits enjoyed by third parties as a result of the irrigation activity. The evaluation of externalities requires the use of alternative methods rather than the traditional one that is based on market price. Stated preference methods use survey techniques to estimate the willingness to pay for a marginal improvement or for avoiding a marginal loss. Revealed preference methods are based on observable choices that allow to directly obtain the resource value (Tietemberg, Lewis, 2012). The main methods of evaluating externalities of irrigation are listed below (adapted from Rosato, 2014):

- Avoided cost is based on the idea that if individuals are willing to support a certain spending to avoid the effects of a certain externality, then the monetary measure of the loss of welfare is at least equal to the amount spent. An example is the positive externalities produced by artificial reservoirs that is used to recreational activity too. The value corresponds to the amount of expenses saved to reach locations that are more distant.
- Substitution cost is based on expenditure that must be sustained to replace it with others, capable of performing the same functions or to provide the same utility. An example is the creation of wetland through historical water derivations. The value corresponds to the cost for the creation of constructed wetlands.
- Production functions method can be used when the externality changes the quantitative and qualitatively resources used as factors of production by agricultural or industrial companies. For example, if the irrigation of an agricultural area makes available additional volumes of irrigation water for a downstream area, the value of externality can be assessed based on the production increases obtained.
- The hedonic pricing method is used to estimate economic values for ecosystem or environmental services that directly affect market prices. For example, if the properties located in a traditional irrigation area characterized by a pleasant and diversified landscape, have a value higher than what they would have if there were no irrigation, then the positive externality of the latter can be evaluated starting by the increase in the value generated.
- Travel cost method derives from the function of demand starting from the behavior of the visitors to the expenses required for going to a place. For example, if a place is visited for the presence of irrigation, the positive externality can be estimated starting from the expenses that the users are willing to pay for getting there.
- The contingent evaluation estimates the externality preferences through an interview with the user. During the interview it is asked what sum you are willing to pay for getting a certain advantage. For example, the interviewee is asked to be willing to pay for the presence of certain characteristics of the landscape given by irrigation.

The choice of method for evaluating each externality should consider the nature of the externalities and effects on the agents involved.

In some contests, to incentive the production of ecosystem services Payments for ecosystem services (PES) are provided; those are an example of production subsidies in their Pigouvian conceptualization (Sattler *et al.*, 2013). Generally, a PES scheme is defined as «voluntary, conditional agreement between at least one 'seller' and one 'buyer' over a well-defined environmental service or a land use presumed to produce that service (Wunder, 2007)». In the case of governmental payment, commonly referred to Pigouvian concept of PES, the role of the buyer is undertaken by the public sector, but it is distinct from the role of the beneficiary, that is represented by the society (or a part of the society). In this case, public sector takes on the role of intermediary, as it negotiates the terms and conditions of the PES scheme, since the direct beneficiaries of the ecosystem services delegate the PES implementation to the public sector. In the public PES schemes, the connection between ecosystem service

payment and beneficiaries should be ensured through the correct use of budget funds, with a view to respecting the beneficiary pays principle (BPP). The implementation of PES schemes requires the monetary evaluation of positive externalities, in order to provide the appropriate incentives that ensure the optimal production of goods that generate ecosystem services. In irrigated agricultural context, PES may encourage farmers to adopt sustainable practices that allow to generate environmental benefits on artificial and natural water bodies. These practices can consist, for example, in maintaining traditional irrigation systems through vegetated uncoated ditches and artificial reservoirs.

3. SUPPORTING ECOSYSTEM SERVICES OF IRRIGATED AGRO-ECOSYSTEM AS POLICY OPTION

As described before, the economic analysis is the main tool for determining the environmental costs and benefits associated with the different water uses. According to WFD and m.d. 39/2015, through economic analysis it is possible to observe: the socio-economic state of the District, and to extrapolate the value of water resources for the sectors; the pressures deriving from the sectors; the measures designed to achieve the environmental objectives (good status of surface water and groundwater); the instruments for cost internalization (price, taxes, obligations).

The environmental cost recovery from agricultural sector, based on the analysis of withdrawal and polluting pressures on water bodies, requires the implementation of measures to achieve the objectives of the WFD to be included in the River Basin District Plans (RBDMPs). In particular, WFD establishes the inclusion of the basic measures (minimum legislative requirements) and, where necessary, supplementary measures; in accordance with the provisions of the European Commission on WFD reporting, measures must be grouped into Key Types of Measures (KTMs), defined as groups of measures identified by Member States in the PoMs which target the same pressure or purpose. There are twenty-five KTMs (Tab. 2), which are setting to include measures for improving water bodies quality and quantity, also referred to hydro-morphological condition.

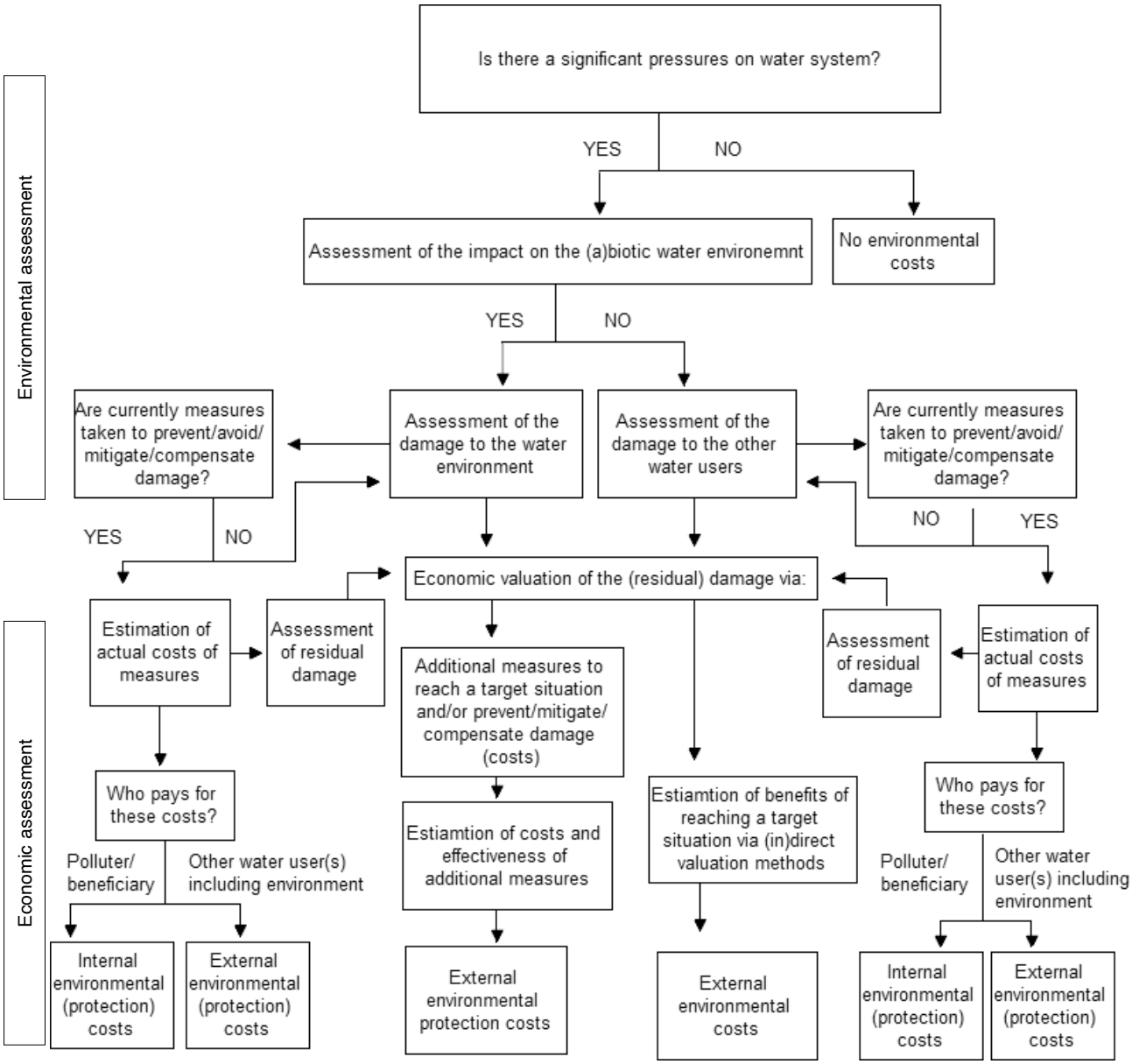
According to the framework of WFD CIS Drafting Group, the environmental cost resulting from negative impacts on water bodies can be considered internalized if the measures carried out to compensate damage are financed by users/polluters (Fig. 2). Ensuring the compliance with the PPP, the flow diagram is the main reference of the Guidelines of the Ministry of Environment's

Tab. 2. List of Key Type of Measures.

KTM number	KTM description
1	Construction or upgrades of wastewater treatment plants.
2	Reduce nutrient pollution from agriculture.
3	Reduce pesticides pollution from agriculture.
4	Remediation of contaminated sites (historical pollution including sediments, groundwater, soil).
5	Improving longitudinal continuity (e.g. establishing fish passes, demolishing old dams).
6	Improving hydromorphological conditions of water bodies other than longitudinal continuity (e.g. river restoration, improvement of riparian areas, removal of hard embankments, reconnecting rivers to floodplains, improvement of hydromorphological condition of transitional and coastal waters, etc).
7	Improvements in flow regime and/or establishment of ecological flows.
8	Water efficiency, technical measures for irrigation, industry, energy and households
9	Water pricing policy measures for the implementation of the recovery of cost of water services from households.
10	Water pricing policy measures for the implementation of the recovery of cost of water services from industry.
11	Water pricing policy measures for the implementation of the recovery of cost of water services from agriculture.
12	Advisory services for agriculture
13	Drinking water protection measures (e.g. establishment of safeguard zones, buffer zones etc)
14	Research, improvement of knowledge base reducing uncertainty.
15	Measures for the phasing-out of emissions, discharges and losses of Priority Hazardous Substances or for the reduction of emissions, discharges and losses of Priority Substances.
16	Upgrades or improvements of industrial wastewater treatment plants (including farms).
17	Measures to reduce sediment from soil erosion and surface run-off.
18	Measures to prevent or control the adverse impacts of invasive alien species and introduced diseases.
19	Measures to prevent or control the adverse impacts of recreation including angling.
20	Measures to prevent or control the input of pollution from urban areas, transport and built infrastructure.
21	Measures to prevent or control the adverse impacts of fishing and other exploitation/removal of animal and plants.
22	Measures to prevent or control the input of pollution from forestry.
23	Natural water retention measures
24	Adaptation to climate change.
25	Measures to counteract acidification

Source: European CWFD Reporting Guidance 2016.

Fig. 2. Flow Diagram to assess and classify environmental costs.



Source: WFD CIS Drafting Group ECO2- Information sheet - 2004.

approach. The method used by Guidelines, proposed by WATECO Group, is the Cost Effectiveness Analysis (CEA). CEA is a technique for identifying the least expensive option to achieve a specific physical goal (Balana *et al.*, 2016). Applying CEA in the context of River Basin Management Plans means to select measures based on their costs and effectiveness. This helps to exclude measures whose cost is out of proportion to the outcomes generated.

According to this approach, the internalization of positive externalities in the context of economic analysis can be assimilated to the setting of PES schemes, but instead of providing direct monetary transfers to farmers, those environmental benefits introduce costs reduction.

According to the legislation framework described, the first step to identify the environmental internalized costs is the identification of the measures already implemented. In fact, if the measures are implemented and the related cost is sustained, the environmental cost can be considered internalized, so they do not configurate anymore as negative externalities.

The aquatic ecosystems linked to irrigated agriculture capable of generating ecosystem services and their maintenance, play a role in this process; in fact, the actions that ensure the ecosystem services flows from water bodies can be considered as measures already implemented. In addition, identifying the funding source, it is possible to determine who/which sector pays for the cost of measures, and if the PPP is respected. Following this approach, a part of the environmental cost connected to irrigation and already internalized by the agricultural sector is the value of actions that maintain and improve ecosystem services from water bodies (included artificial ones of irrigation agro-ecosystem) financed through:

- public financial resources (for example through European Agricultural Fund for Rural Development (EAFRD) that respond to focus areas 4b (Improving water management) and 5a (increasing efficiency in water use by agriculture);
- financial resources of Irrigation Consortia;
- financial resources of farmers.

Examples of measures that can be implemented, whose related cost is sustained (so that the environmental cost can be considered internalized) through financial resources of the agricultural sector, are: costs related to the respect of obligations set by the legislation on sustainable use of pesticides and on nitrates; actions for soil management aimed to preserve water bodies quantity and quality, since pollution at the field scale can compromise status of groundwater due to percolation processes and to run-off; ecological engineering, nature-based solutions, green infrastructures, that can improve the flow of ecosystem services, the construction of riparian buffer strips on irrigation canals for water purification, wetlands construction for habitat, maintaining and restoration of uncoated canals for aquifer recharge (also maintaining adequate levels of waters) and for fish life, resurgences restoration etc. Most of those measures are implemented by Irrigation Consortia and are financed by Regional Rural Development Programmes (public funds) or by their own budget (private - farmers funds).

Other example refers to the Natural Water Retention Measures (NWRMs). Natural Water Retention Measures, multi-functional measures that aim to protect

Tab. 3. List of Natural Water Retention Measures.

A1	Meadows and Pastures	U1	Green roofs	N1	Basins and ponds	F1	Forest riparian buffers Forest riparian buffers
A2	Buffer strips and hedges	U2	Rainwater Harvesting	N2	Wetland restoration and management	F2	Maintenance of forest cover in headwater areas
A3	Crop rotation	U3	Permeable surfaces	N3	Floodplain restoration and management	F3	Afforestation of reservoir catchments
A4	Strip cropping along contours	U4	Swales	N4	Re-meandering	F4	Targeted planting for 'catching' precipitation
A5	Intercropping	U5	Channels and rills	N5	Stream bed re-naturalization	F5	Land use conversion
A6	*No till agriculture*	U6	Filter Strips	N6	Restoration and reconnection of seasonal streams	F6	Continuous cover forestry
A7	Low till agriculture	U7	Soakaways	N7	Reconnection of oxbow lakes and similar features	F7	'Water sensitive' driving
A8	Green cover	U8	Infiltration Trenches	N8	Riverbed material renaturalization	F8	Appropriate design of roads and stream crossings
A9	Early sowing	U09	Rain Gardens	N9	Removal of dams and other longitudinal barriers	F9	Sediment capture ponds
A10	Traditional terracing	U10	Detention Basins	N10	Natural bank stabilisation	F10	Coarse woody debris
A11	Controlled traffic farming	U11	Retention Ponds	N11	Elimination of riverbank protection	F11	Urban forest parks
A12	Reduced stocking density	U12	Infiltration basins	N12	Lake restoration	F12	Trees in Urban areas
A13	Mulching			N13	Restoration of natural infiltration to groundwater	F13	Peak flow control structures
				N14	Re-naturalisation of polder areas	F14	Overland flow areas in peatland forest

A= Agriculture; U=Urban; F=Forest; H= Hydro morphology.
Source: Synthesis document n°1 Introducing Natural Water Retention Measures: What are NWRM? NWRM project.

water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes. NWRMs can be applied in the RBMP framework under the Water Framework Directive (WFD) or the Flood Risk Management Plans (FRMP) under the Floods Directive (FD). Table 3 shows a list of NMRMs classified by sectors: Agriculture (A), Urban (U), Hydro morphology (N) Forest (F). Each measure can generate biophysical impacts and consequently some specific ecosystem benefits.

To consider the internalization of positive externalities in the context of economic analysis it is necessary to evaluate those actions, as they support the capability of irrigated-agroecosystems to provide ecosystem services. To assign an economic value it is possible to follow suitable methods from literature on ecosystem services evaluation, recalled before. From those reviews, substitution cost method seems to be the most suitable technique in terms of compliance with the WFD cost-based approach. The existence of elements of irrigated agro-ecosystem capable of explicating the same function of measure planned in RBDMPs allows to estimate the value of those elements. In this context, the Geo-referenced Information Systems (GIS) analysis plays a key role, since maps and models of ecosystem services allow to identify where ecosystem services are produced, to quantify changes in service provision over time and to describe the production of ecosystem services as a function of patterns of land use, climate and environmental variation (Maes *et al*., 2011). Once the agro-ecosystem structures are identified the services provided through their interaction with the surrounding ecosystems should be quantified in biophysical terms. The value of these elements, estimated through the cost of corresponding measures, would constitute a part of internalized cost by agricultural sector.

4. CONCLUSIONS

The recognition of benefits provided by irrigated agro-ecosystem leads to considerate water use in agriculture not only as a source of pressures, but also considering the positive interaction between water resource and other elements of the territory, due to the distributive function of irrigation systems. These interactions should be supported through some suitable measures, equipping artificial ecosystems of the elements that support ecosystem services flow.

Economic analysis of water uses allows to combine environmental and economic issues related to water uses, following current environmental accounting approaches. The accounting of the impacts on water bodies as environmental cost, through the measures program, offers the possibility of highlighting the actions capable of improving water bodies' quality and quantity, also considering environmental value of aquatic ecosystems dependent on agricultural activity. In this context, it is important to adopt environmental accounting schemes not only at national level, but also at the level of water resource managers. These schemes would allow to report the data on the incoming and outgoing resource flows of the various sectors of use to estimate the significant pressures on water bodies, but also the financial resources allocated for the implementation of measures for the protection and improvement of the water bodies. In this way, it is possible to establish the contribution to environmental cost recovery of water resource for agriculture, considering not only the financial aspect given by the price paid using the resource but also the contribution in terms of the overall impact on water resource. In addition, the mapping of ecosystem services is fundamental for the evaluation of the measures already implemented. In this context, Geo-referenced Information Systems represent a suitable tool for identifying the elements of the agro-ecosystem and their interactions capable of improving the quantitative and qualitative state of groundwater and surface water.

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Adopting irrigation advisory services for water footprint estimation to improving biodiversity conservation: a European survey

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Abstract. In many European regions the Irrigation Advisory Services (IASs) are adopted by farmers for sustainable irrigation practices. These tools are adequate to facilitate the adoption of environmental certification schemes, such as water footprint, which could improve the sustainability of production processes. As part of a survey conducted on 116 farmers among Italy, Greece and Croatia, it was possible to understand their level of awareness with respect to the certification systems in order to evaluate possible actions to be taken to increase awareness of their use. The results showed that farmers still have a certain unawareness with respect to the true added value, in economic terms.

Keywords: environmental certification, water footprint, decision support systems, agricultural extension services.
JEL codes: Q25.

1. INTRODUCTION

Food production at household level generally requires the use of genetic resources that are well adapted to the local environment, particularly in areas where the environment is harsh and other inputs are difficult to access. The conservation and sustainable use of genetic resources and access to genetic material allow farmers to improve and diversify food production and thus access to enough food. Biodiversity for food and agriculture improves the access of households to food in different ways (Ebert, 2014). First, contributes to raising agricultural production, increased agricultural production results in greater access of farm households to food, directly through subsistence production of food.

However, where access to other essential productive assets, such as land and water, is lacking, access to improved genetic resources alone will not improve access to food (FAO, 2017). This leads to impacts on biodiversity in wetlands and terrestrial systems that are dependent of the availability of water (Verones, 2017). According to FAO (2015, 2016), in 2012, 324 million

hectares were equipped for irrigation worldwide. Furthermore, irrigated agriculture is responsible for around 70% of the world freshwater withdrawals (Ringler, Zhu T., 2015; WWAP 2009, 2015).

The expansion of irrigated agriculture and occurrence of drought caused by climate change, in the Mediterranean area denote that irrigation water demand will continue to increase in the future (WWAP, 2015). Moreover, the Mediterranean area has low water resources per habitant, and is thus considered a water-stressed area (Pereira, 2004; Mancosu, 2015).

In addition, further improvements in productivity will require higher use of irrigation, increasing the energy demand for moving water into the fields that can increase GHG emissions. (Mosier, 2001). Otherwise, more effective irrigation measures can enhance carbon storage in soils through enhanced yields and residue returns (Follett, 2001; Lal, 2004a).

In this framework comprehensive tools are therefore required to assess impacts of water use for irrigation needs on biodiversity. Thus, the adoption of adequate water accounting tools to measure or estimate water productivity and efficiency, and which supports the decision-making process at a technical and political level including consumption choices, is becoming crucial, improving at the farm level the water productivity (Rinaldi *et al.*, 2011; HLPE, 2015; Ventrella *et al.*, 2015).

In the agricultural sector, the demand for water can be affected by reductions in the availability of water for crops, forcing farmers to revise their approach in some cultivation cases with effects on biodiversity. In fact, adaptation measures to climate change may require the use of less water demanding crops.

Recently, a combination of the above mentioned factors have contributed to the development of Irrigation Advisory Services (IASs) at farm level, often of high technological value, for the rational use of water for irrigation. IASs help farmers to optimize crop productivity and cost effectiveness by providing them with irrigation scheduling information based on the actual crop development (Altobelli *et al.,* 2018), thus they are suitable management instruments to achieve a better efficiency in the use of water for irrigation.

Tools such as high-tech irrigation systems will play a key role in the future for the challenges that climate change will impose (Altobelli, *et al.* 2015). Earth Observation (EO) for agricultural water management is a mature technology and it is ready for being transferred to operational applications. Presently, some systems based on EO data are used in IASs and are recognized as useful tools for improving water management in agriculture. EO-based IASs provide new services for water managers and food producers at field scale, and a range of additional products for a sustainable irrigation management at district scale, especially for areas affected by water scarcity and drought. Such systems use EO datasets as the core information for the irrigation decision support systems that produce irrigation requirement maps at different scales: from farm to irrigation district up to the entire watershed. In addition, data on crop development and irrigation requirements are timely produced and distributed to farmers by information and communication tools (e.g. smartphones and e-mail). Moreover, recent studies initiated to investigate the potential of using EO technologies in the field of irrigation water management, through the assessment of crop water footprint (Dalla Marta *et al.,* 2015; Altobelli *et al.,* 2015).

The water footprint (WF) is a consumption-based indicator of freshwater use, accounting for the appropriation of natural capital in terms of the water volumes required for human consumption (Hoekstra *et al.,* 2009). It looks at both the water formed by rain infiltrated into the soil (green component) and the water formed by rainfall, thus water that escapes evaporation and can be found in rivers and aquifers (blue component). More specifically, the WF of crops is defined as the volume of water consumed for its production provided by natural soil water content (green) and by irrigation (blue). The proportion of blue and green water depends on many factors, including climate, soil type, crop and crop management, and irrigation practices.

The ISO 14046, Water footprint, provides decision makers in industry, government and non-governmental organizations with means to estimate the potential impact of water use and pollution. More specifically, a water footprint assessment helps to assessing the magnitude of potential environmental impacts related to water; ways to reduce potential water-related impacts of products at various lifecycle stages; facilitates water efficiency and optimization of water management at product; provides scientifically consistent and reliable information for reporting water footprint results (www.iso.org).

In order to understand the real possibility of adopting EO-based IASs for deriving all the input data required by the WF assessment method, and use them for large-scale territorial certification tool to improving biodiversity conservation, a European survey was conducted among Croatia, Greece and Italy.

The main research questions that have been investigated to understand the opportunity offered by IAS for WF applications in order to preserve the biodiversity, have been oriented to understand the perception, the awareness, the attitude that farmers have towards the certification tools.

2. METHODOLOGY

The study was conducted between 2014 and 2015 in Croatia, Greece and Italy. A structured questionnaire was administered through face-to-face interviews among 116 farmers. Research has been divided into 2 phases. The questionnaire, that was translated into the original language for each country following a forward and backward translation process (English/language of each country) and pretested on a small sample of farmers (a total of 15), focus group, before the survey (Holmes *et al.*, 2017).

The results from preliminary focus groups conducted among farmers and different stakeholders (e.g. farmers' associations and land reclamation consortia) in each country, as a proper activity of the EURO-AGRIWAT COST Action, provided evidence about the importance of the certification for soil, water and biodiversity protection as well as sustainable practices by farmers (Altobelli *et al.,* 2019). The adoption of this methodology has been selected as it is proved to be a valid qualitative methodology also for investigating the psychological aspect of the interviewers (Migliorini & Rania, 2001). In particular, the sample was constituted by farmer groups and the questions related to benefits expected by farmers regarding the adoption of innovation in agriculture water management were addressed to understanding their perception of innovation in irrigation water management.

During the second phase, focus groups results were used to define a list of effects expected from the introduction of an innovation, environmental certification, into the farms. In this second step behavioural scales have been used to define the appreciation of the expected effects from the introduction in the agriculture holding of an innovation (Proietti, 2000). In our analysis, the respondent was asked to express his/her level of agreement/disagreement using a 7-Point-Likert-Scale ranging from: strongly disagree to strongly agree. The sum of the scores to the totalized answers from each individual interviewed gave the position (numerical value) of the attitude of the subject appearance / concept investigated.

During farmers interview was asked to express their level of attitude with respect to six specific issues. The first addressed to understand their level of knowledge with respect to the environmental certification. The second to assess the attitude towards the effects of the adoption of environmental certification on the production process of the agricultural company, and how it can be crucial for environmental quality. The third was aimed to know the attitude that farmers have of environmental certification and if adoption of certification systems determines an increase in terms of production costs. The fourth issue was related to understanding their point of view regarding opportunities or threats that environmental certification can have on the external pressure on farms from industrial sector or customers. Fifth issue was related to the opportunity that the environmental certification can have in terms of increasing the economic benefits, income, at farm level. Finally, six issue was related to the preferences regarding a specific environmental certification scheme. In fact, preliminary analysis of the existing eco-schemes related to agricultural products provided evidence on the lack of certifications related to natural resources as soil and biodiversity, as opposite to water (i.e. water footprint) and sustainable practices (see for instance organic production). To bridge this gap, during farmers interview was asked to express their preference for the certification of reduced soil impact, the certification of reduced water use (aimed to face water scarcity issues) and the certification of biodiversity conservation. In particular, the certification of biodiversity conservation refers to the implementation of a production process focused on protection of biodiversity. Soil and water certification refers to land conservation (mainly in terms of the quality of the soil) and the water saving in agriculture (i.e., water footprint certification, respectively). Sustainable production certification refers to a technically advanced form of agriculture that can preserve natural resources and the environment, and that is associated with lower input use and lower environmental impact, compared to conventional agriculture. Farmers were also asked to express their preferences for one other attribute related to the certification adoption, the typology of certification (private or public).

3. RESULTS AND DISCUSSION

The majority of the respondents have a low level of knowledge about environmental certification, accordingly the 35% of farmers rated their level of knowledge as 2, while only 1% of the respondents selected 7 (maximum level of knowledge), and the 7% selected the option 6 (Fig. 1). Farmers did not consider environmental certification crucial for the environmental quality as the 17% of respondents selected option 1 and 23% selected option 2 (Fig 2). Most of the farmers argue that the environmental certification could increase the cost of production: the 46% of farmers liked option 1 and 3 while the 23% of respondents pronounced themselves neutral (Fig. 3). 27% of farmers were not sure that environmental certification decreases the external pressure, coming from customers, of their farm (Fig. 4). This result con-

Fig. 1. Level of knowledge with respect to the environmental certification.

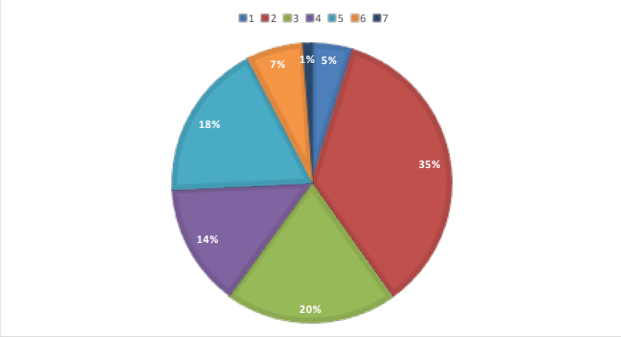


Fig. 2. Environmental certification crucial for environmental quality.

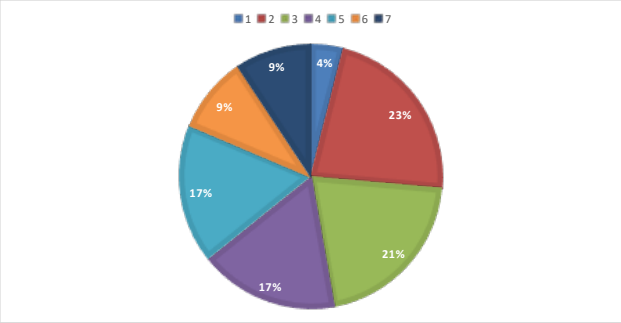


Fig. 3. Environmental certification increases the cost of production.

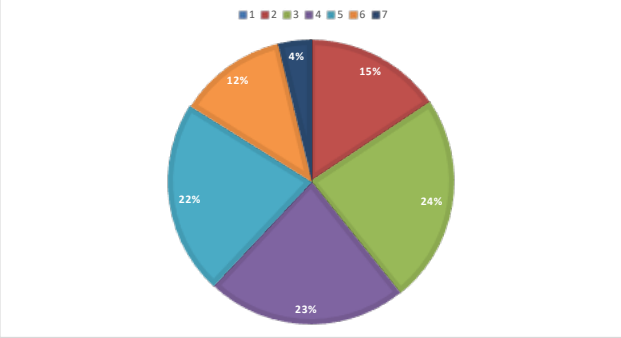


Fig. 4. Environmental certification decreases the external pressure on farm from industrial sector or customers.

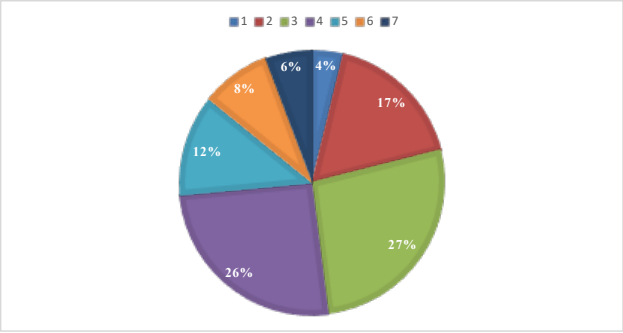


Fig. 5. Certification increases the economic benefits, income, at farm level.

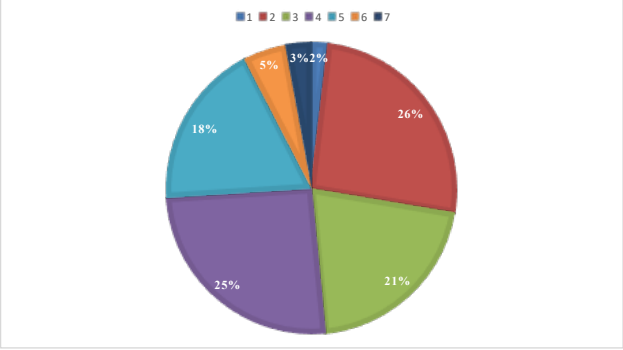
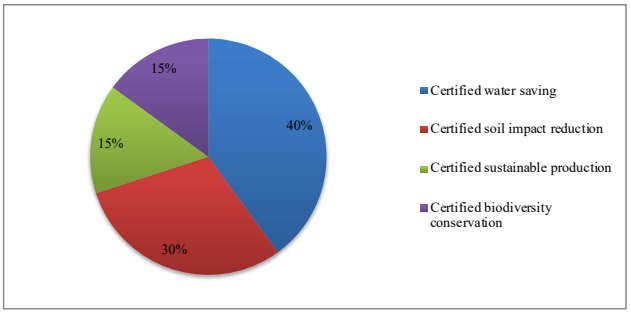


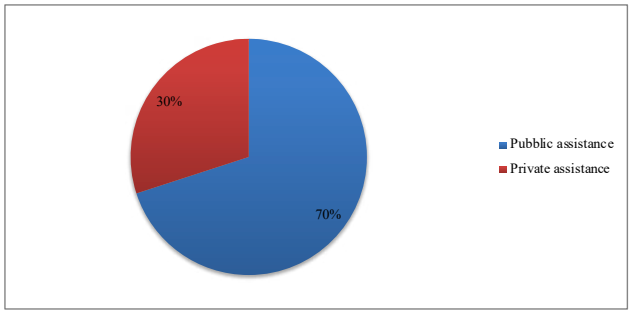
Fig. 6. Certification of environmental sustainability.



firms that farmers are not sure that the adoption of an environmental certification is the only tool, which can significantly reduce the environmental responsibility of companies with respect to the production process adopted in relation to consumers. To the respect of this question the 26% of farmers stated their neutrality while only the 17% gave a positive judgement (liking options 6 e 7). Lastly, almost the half of the farmers (47% liked option 2 or 3) claimed that environmental certification does not

two aspects, as stated by Liu *et al.* (2018) and Altobelli (2019). Certifications related to biodiversity and sustainable practices are less preferred. Moreover, evidence in the current study shows that farmers are more willing to appreciate a public certification scheme compared to a private one. This evidence indicates that this is a potential area of interest for the public funding in the near future.

Fig. 7. Assistance on environmental sustainability certification.



4. CONCLUSION

The results of the investigation show that farmers are not completely aware about environmental certification. The lack of basic knowledge on these tools could explain why farmers are not so sure of their operation and why they consider environmental certification to be expensive, increasing their production costs. Furthermore, for farmers environmental certification is not the main and appropriate tool to increase environmental sustainability. Increasing concerns about sustainability in agricultural sector need more tailored certification schemes to satisfy users' preferences. However, there is a lack of knowledge about farmers' preferences for specific attributes of a certification and, as a result, its relative effectiveness in encouraging the adoption of sustainable practices. Knowledge is critical to increase farmer awareness of the environmental benefits of a certification scheme. Albeit our sample is not representative, the empirical results give interesting insights to both researchers and public-private promoters toward a more effective and more attractive design of eco-labels and environmental certification schemes.

The results of this survey also prove that beyond the maturity of certain certification systems, such as a water footprint, and despite having reached a very high level of reliability due to its estimation, there are many steps to be taken to increase farmers' awareness on the usefulness of environmental certification as a tool for safeguarding natural resources and biodiversity.

Results allowed deepening our knowledge about the possibilities offered by including the water footprint in the environmental certifications, and about which aspects are more important to increase their adoption in the agricultural context.

Furthermore, the importance of IASs for estimating the environmental impact due to the use of water in agriculture has also been highlighted by the obtained results.

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Identification of High Nature Value Farmland: a methodological proposal

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Abstract. The concept of HNVF raises thanks to the integration of biodiversity theme into the CAP. The precise definition of the topic and the application of a correct identification procedure deeply affect the assessment needs of European RDPs. Nevertheless, the level of HNVF knowledge is rather limited due to a methodological variability and a structural lack of suitable data. The research aims at overtaking HNVF identification difficulties complying with specific Community requirements and the use of an efficient theoretical framework that allows accurate location and monitoring over time. The methodology results in characterization and accurate HNVF map for the Apulia Region that can effectively calibrate the implementation of the regional management policies.

Keywords: biodiversity, agricultural intensity, natural value, GIS, landscape, ecological economics, ecosystem services, biodiversity conservation, bioeconomics, industrial ecology.
JEL codes: Q570.

1. INTRODUCTION

1.1 Definition of high natural value and classification of HNVF

The radical changes that have affected agricultural systems and agricultural landscapes in relatively recent years have led agricultural areas to play a key role in the conservation of specific habitats for many animal and plant species. The concept of High Nature Value Farmland (HNVF) was created in response to the need to safeguard biodiversity even outside the habitats placed under special protection regimes (for example those deriving from the Habitats Directive), also considering the growing attention of local communities towards the issue of biodiversity and agro-biodiversity conservation programs (Sardaro, *et al.*, 2016). In Europe, the concept of HNVF developed in the early 1990s (Baldock *et al.*, 1993; Beaufoy *et al.*, 1994), focusing attention on agrarian systems characterized by low density of cultivated plants and farmed animals, a reduced use of chemical inputs

and a massive use of labour-intensive practices, especially manual (such as sheep-farming). This concept has progressively evolved thanks to the integration of environmental issues within the Common Agricultural Policy (CAP). In this regard, high-nature value farmlands are those areas where agriculture represents the prevalent land use and to which is associated the presence of a high number of species and habitats, as well as particular species of Community protection concern. These are areas whose low agricultural intensity matched well with a high presence of semi-natural vegetation or with agriculture that gives the landscape a mosaic appearance; the latter defined by a diversified ground cover richness in semi-natural and artificial. According to some recent estimates provided by the quantification of the context indicator number 37 of the CMEF[1] (European Commission, 2015), about 32% of European agricultural areas is qualified as High Nature Value (mainly concentrated in Eastern and Southern Europe). Particular habitats, such as semi-natural grasslands, steppes and small mosaic areas with numerous landscape elements constitute these areas; HVNFs are also abundantly present in mountain areas. In Italy, these agricultural systems can be mainly associated with semi-natural pastures, permanent meadows, traditional orchards and arable crops (Trisorio *et al.*, 2012).

Specific projects promoted by the European Environment Agency (Andersen *et al.*, 2003) and the European Commission (IEEP, 2007a and 2007b) identified the key features of HNVF. They are identified in low-intensity agricultural systems; semi-natural vegetation; high diversity of land cover. The above-mentioned researches have shown that the dominant feature of HNVF is the low intensity of the agricultural activity carried out together with the presence of semi-natural vegetation. In the case in which the latter is reduced, however, a high degree of diversity of land cover (mosaic structure) together with a low intensity of production activities can still ensure significant levels of biodiversity, especially in the presence of sufficient elements capable to preserve ecological niches. However, even areas with intensive farming can allow the maintenance of important species of conservation interest (for example, birds), so that the only degree of diversity of land cover does not allow to verify univocally the presence of HNVF.

From the aforementioned works and from the analysis of the literature we can see that classification in three typologies of the HNVF areas already exists:

- Type 1: Agricultural land with high coverage of semi-natural vegetation;
- Type 2: Agricultural lands dominated by low-intensity agriculture or by a mosaic of semi-natural and cultivated territories;
- Type 3: Agricultural land with rare species or a high proportion of animal and/or plant species of conservation interest at European or world level.

However, even today the level of definition of HNVF, in scientific terms, as well as in relation to their spatial distribution is still rather limited, on both a European scale and, even more, a national and regional scale. The necessary systematization and consequent identification are dictated, in addition to the positive externalities (Madureira *et al.*, 2013), also from the observation that an adequate cognitive system can allow modulating, adequately, effectiveness and efficiency of policies regarding the different types of agricultural areas they are implemented on.

In recent studies, scientists pay attention to the characterization of HNVF from a social and environmental point of view. The main idea is to connect HNVF with ecosystem services provided by agricultural habitat such as carbon storage, flood control or water purification, support services such as oxygen atmospheric production or cultural services where agro-tourism occupies an increasingly relevant role (Dumitrascu, *et al.* 2018). In other words, links among traditional farming practices and survival of viable rural communities are investigated. Other researchers deal with micro properties of HNVF: Vigani and Dwyer (2019) propose a characterization of farms in marginal economic and high nature value conditions aiming to help to identify farm-level management and policy options for economic, environmental and social sustainability. Moreover, post-2020 CAP reform confirms the attention towards environmental sustainability, biodiversity and landscape (as well as a fair income for farmers). Main changes of post-2020 CAP concern the way Member States (MSs) will determine how to achieve objectives and targets, assuring a more tailored use of CAP support. The 'performance-based delivery model' gives much subsidiarity and responsibility to MSs that are asked to set objectives and targets also for semi-natural/semi-improved agricultural habitats (not listed in Annex 1) that are declining, or at risk of declining, and their associated farmland species. HNVF will have a key role in future CAP while MSs are still developing ways of mapping, targeting and monitoring the location/extent of HNVF (IEEP, 2018). Mapping HNVF at the regional or national scale is a complex object of research also because, as with habitat quality indicator (CICES Version 5.1, 2019), HNVF is a non-specific indicator, that needs to be treated with unavoidable assumptions and generalizations.

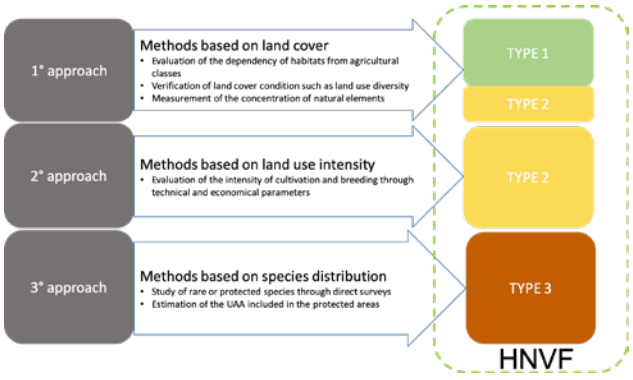
[1] Common Monitoring and Evaluation Framework of the Common Agricultural Policy.

1.2. Aspects concerning the identification of HNVF

The methodological variability described by the literature is usually associated with a structural lack of data and information needed for correct identification of the HNVF areas. The three typologies identified by Andersen pose different problems about their characterization and individuation. For this reason, two complementary approaches have been developed, to which a third is added (although less used in the studies conducted so far). The first, starting from the analysis of the «land cover» is based on the relationships existing between the «agricultural classes» and between «agricultural classes» and protected habitats and species. The second considers the study of farm types combining agronomic and economic data. The third studies the effective distribution of wild species in agricultural areas (Fig. 1). It highlights how the Institute for European Environmental Policy (IEEP) in the most recent report on the topic (IEEP 2014) encourages the individual EU States and the administrations involved to operate at least a joint use of the first two approaches to ensure correct identification of HNVF areas.

On an operational level, the work of Andersen *et al.* (2003) identified the potential HVNF areas on a European scale by combining the cartographic information of the Corine Land Cover (CLC) with the statistical-economic information of the Farm Accountancy Data Network (FADN). Although useful for an overview, such maps designed and implemented throughout the EU still require more detailed data, taking into account national and, obviously, regional data sets. For these reasons, JRC and EEA carried out a review of the methodological part, concerning the mapping of the land cover, which led to the development of a new map on a European scale in the period 2005-2007.

Fig. 1. Methodological approaches used in literature by type.



Source: our elaborations.

The work widespread by the Italian National Rural Network (NRN, 2014) follows the land cover approach and uses data from the statistical survey AGRIT2010 of the Ministry of Agricultural and Forestry Policies (MIPAAF) integrated with data derived from CLC and from the database of Italian sites designated at national or European level interest in protecting habitats of community interest. In fact, even if CLC appears today the best available source of land cover data it is clear that its use as an instrument aimed at the localization of HNVF on a regional scale has several limits, such as the greater detail required, the low updating frequency and the absence of elements pertaining to the intensity of cultivation[2]. Another study recently conducted in Apulia (Campedelli *et al.* 2018) focuses on the analysis of territorial suitability to host species of birds of conservation interest. It, therefore, follows the third approach to evaluate the HNVF quality starting from NRN identification results.

The European Evaluation Helpdesk for Rural Development[3] has published an interesting document to allow the construction of a methodology that responds to specific knowledge and monitoring needs on HNVF areas either at a state or at a regional level. An important point concerns the need to define HNVF areas in a spatially explicit form. This requires conducting the analysis in a GIS environment and using geo-referenced data and information. It is also necessary to integrate methods based on land cover (HNVF type 1 and 2) and methods based on cultivation/breeding intensity (HNVF type 2) and possibly methods based on the distribution of species (HNVF type 3). The approach must also be dynamic to allow monitoring of the evolution of the phenomenon. The data used in the analysis must necessarily follow the changes occurring in the agricultural areas and the recording of these variations must take place in a short time to appreciate the changes in the quantity and distribution of the HNVF areas. Data used in the analysis can be secondary or primary. These may be specific to HNVFs or be part of larger biodiversity and habitat monitoring programs (Oppermann *et al.*, 2012). It is also necessary to record the qualitative variations of the HNVF areas and the steps that can take place from one qualitative status to another, in terms of intraspecific variations (increase or decrease in the level of biodiversity and/or

[2] Analysis of the literature shows that the data used in the studies concerning the identification of HNVF areas derive essentially from Corine Land Cover 2012 (IV Level), Regional Thematic Maps, Habitats and Nature Maps with indication of the overall index of ecological value (corine Biotopes), from the hydrography and orography maps.

[3] Directorate-General for Agriculture and Rural Development - Unit E.4 (2016): Working Document Practices to Identify, Monitor and Assessment HNV Farming in RDPs 2014-2020.

natural value within a typology HNVF) or interspecific (transition from one HNVF type to another). To appreciate the changes, obviously, the use of the same methods and data sources is strongly recommended.

2. METHODOLOGY

2.1. Methodological approach

The aim of these researches is to identify a methodology that allows quantifying, localizing and monitoring over time HNVF areas at the regional level. It is based on a solid theoretical framework developed by Andersen (2004) and on the criteria proposed by the European Evaluation Helpdesk for Rural Development.

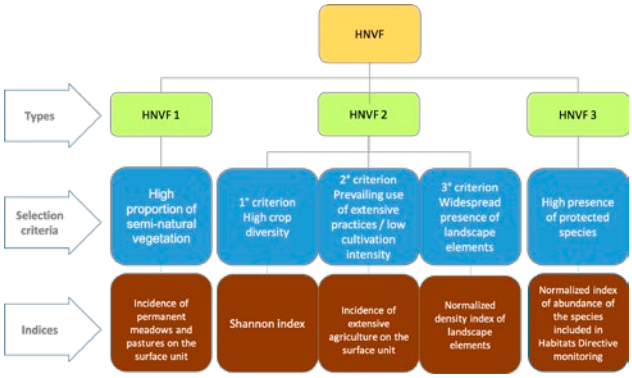
The theoretical framework allows structuring the methodology adopted through a cascade process highlighted in the following steps:

- identification of the most appropriate single or multiple criteria to break down the three types;
- choice of the indexes that return the types and choice of the aggregation methods between indicators;
- selection of indicators measuring the phenomenon defined by the index and corresponding to the chosen criteria;
- choice of data sources;
- choice of the format of the analysis and the geographical scale of the survey;
- selection of spatial analysis tools for data conversion.

2.2. Description of the methodology

Starting from the above-mentioned framework, the concept of HNVF can be considered from two points of view: the naturalness of the areas and the type of management of the agricultural systems. The territorial naturalness is determined by the predominant land cover within each agricultural system, with reference to the agricultural land use, to the types of semi-natural vegetation, to the elements of biodiversity, to the landscape elements and the historical-cultural value. Instead, the component of the management of agricultural systems is determined on a farm scale, with reference to the cultivation models and the intensity of use of fertilizers, plant protection products, irrigation and mechanization. In order to select the indices and the indicators used to satisfy the criteria of HNVF areas, a check was made on the naturalness elements and on the type of management of the agricultural systems.

Fig. 2. Scheme for the identification of HNVF area types based on criteria and relative indices.



Source: our elaborations.

Figure 2 describes the criteria adopted to allow, as mentioned, the decomposition of the three types or to allow the re-composition of the indices (and the indicators) in a way that guarantees the satisfaction of the prescriptions of the theoretical framework. Furthermore, based on the criteria, the indices and the most appropriate aggregation methods are defined. The choice of the indices also derives from their ability to directly measure the phenomenon that defines the type, as in the case of types 1 and 3, or the possibility of being able to aggregate them in a logical manner, as in the case of type 2[4].

HNVF type 1 areas are identified starting from territories where agriculture is the predominant use and where it is carried out with the concomitant high presence of natural or semi-natural spaces. Several sources (for example the comparison between the land use map and the Nature Map[5]) show a frequent overlap between the agricultural areas belonging to the classes of meadows, natural and uncultivated pastures with habitats of significant naturalistic value. The correct identification of natural meadows and pastures is therefore of fundamental importance for the identification of type 1 HNVF areas.

The second type of agricultural areas with a high naturalistic value is identified by the presence of three aspects of the agricultural territory attributable to the low intensity of cultivation in support of biodiversity. In particular, crop diversity requires a limited specialization of production and greater complexity of the agricultural landscape, benefiting the spread of wild species. Moreover, the presence of extensive practices is defined by poor use of agricultural inputs, therefore a limited

[4] For type 2 HNVF areas, a non-compensatory aggregation of the 3 indices was chosen to allow compliance with the criteria.
[5] ISPRA, 2004 and 2009.

disturbance for biodiversity. Finally, agricultural landscape elements constitute an important refuge and territorial connection features for the wild species.

As mentioned, the logical process and the consequent elaborations are crucial to define the second type of HNVF areas, strongly linked to the following criteria:

- 1st high crop diversity;
- 2nd prevalent use of extensive practices;
- 3rd diffuse presence of agricultural landscape elements.

In the first case, the presence of an identifiable «agro-ecomosaic» is assumed with a sustained diversity of the crops present in the analysis unit. The employment of a diversity index can represent the richness of the «agro-ecomosaic». Shannon's diversity index (Shannon, Weaver, 1949; Pielou, 1975; Magurran, 1988; McCarigal, Marks, 1995; Crimella *et al.*, 2001; Turner *et al.*, 1989, 2001) is able to measure diversity of the agricultural landscape in terms of «agro-ecomosaic» richness. The greater the value, the greater the degree of diversity registered in the unit of analysis.

The second criterion related to the identification of the second HNVF type requires that areas of the investigated territory are identified where agriculture is extensive or where the agricultural practices used are extensive. In the literature, the intensity of agricultural land (Turner & Doolittle, 1978; Temme & Verburg, 2011; Teillard *et al.*, 2012) refers to the level of use of input (water, mechanization, fertilizers and plant protection products). The greater the application of them, the higher the level of intensity of agricultural activity carried out in those agricultural systems.

Finally, it should be noted that the structural elements of the agricultural landscape are important features as these elements represent, in predominantly agricultural land, the ecological corridors that are decisive for shelter, for food search and for movement needs of wild animal species as well as important ecotones for wild plant species. The density of these elements on the surface unit represents, quantitatively, the capacity of the agricultural territory to provide benefits deriving from the presence of ecological corridors. The three criteria, if satisfied simultaneously in a defined territorial unit, give rise to HNVF area of the second type, highly representative of the capacity of agriculture to conserve animal and plant biodiversity[6].

The third type of HNVF areas may seem apparently simple and easy to understand. Instead, even in the presence of a conventional type of agriculture (and in the absence of particular elements of widespread naturalness) it is necessary to consider the presence of animal and plant species of non-agricultural interest. The abundance criterion of species of conservation interest can define these areas.

According to the framework steps described, Table 1 contains the overall synoptic table, which, starting from the indices, proposes the indicators that are able to measure every single phenomenon included in the index. Each choice complies with the theoretical framework. In fact, all the indicators can be calculated by using one or more alternative data sources, each of which is evaluated in terms of the possession of specific requisites (spatial detail, dynamism, updating). These requirements determined the choice of data sources[7].

According to Table 1, the geographic information system was prepared and developed by using the following information layers:

- Sentinel-2 Multiband Satellite Data.
- FADN Database.
- Species distribution maps from the Habitat Directive monitoring program.
- Apulia Regional Technical Map.

With regard to the data source, the need to identify a dynamic and at the same time speedy instrument that does not involve the high costs of direct investigations, let it look with particular care to the use of Sentinel 2 satellite images. Sentinel-2 is the newest generation Earth observation (EO) satellite of the European Space Agency (ESA) for land and coastal applications included crop and forest classification. The satellite, launched on June 2015, is part of Europe's Copernicus program aiming at independent and continued global observation capacities. Compared to Landsat satellites, Sentinel-2 offers an increased spectral and spatial resolution with 13 spectral bands of 10 to 60 m spatial resolution (Vuolo *et al.*, 2016). Moreover, in terms of temporal resolution, Sentinel-2 give an adequate update possibility with a combined constellation revisit frequency of 5 days. In comparison, Corine Land Cover, commonly used for such purposes, precisely identifies the land use classes that represent the starting point for the calculation of indexes. It has a good thematic resolution not supported by a time resolution (about 5 years) and a spatial resolution (Minimum Mappable Unit of 25.000 square meters), able to provide adequate disposing of the transformations taking place on agriculture landscape. Moreover, in the same way, the National Agricultural Census has a too long updating period and a geographical detail unit too large (Municipality).

The use of satellite images requires the application of appropriate methods for remote sensing such as super-

[6] Operationally this means that a non-compensatory aggregation method has been adopted.

[7] For example, the CLC was considered unsuitable because it did not meet the requirement of dynamism, or frequent update.

Tab. 1. Evaluation of indicators and data sources.

Indices	Indicator	Source	Spatial detail	Dynamicity	Update
Incidence of permanent meadows and pastures on the surface unit	Incidence of permanent meadows and pastures on the surface unit	Sentinel 2	Raster with a 10m cell	yes	5 days
Shannon index	Incidence of the arable lands on the surface unit	Sentinel 2	Raster with a 10m cell resolution	yes	5 days
	Incidence of the woods on the surface unit				
	Incidence of the permanent crops on the surface unit				
	Incidence of the vines on the surface unit				
	Incidence of permanent meadows and pastures on the surface unit				
	Incidence of inland water on the surface unit				
Incidence of extensive agriculture on the surface unit	Area covered by arable lands with low use of agricultural inputs	RICA data on the use of water, fertilizers, plant protection products and mechanization per hectare	Punctual data from RICA sample survey (necessary interpolation)	yes	annual
	Area covered by vines with low use of agricultural inputs				
	Area covered by permanent crops with low use of agricultural inputs				
	Incidence of the woods on the surface unit	Sentinel 2	Raster with a 10m cell resolution	yes	5 days
	Incidence of permanent meadows and pastures on the surface unit				
Normalized density index of landscape elements (aggregated index)	Agricultural point elements density (trees outside forest or isolated trees)	Regional technical map	Punctual geometries	partly	10-15 years
	Agricultural line elements density (trees outside forest or isolated trees)	Regional technical map	Linear geometries	partly	10–15 years
	Incidence of the woods on the surface unit (polygonal elements)	Sentinel 2	Raster with a 10m cell resolution	yes	5 days
Normalized index of abundance of the species included in Habitats Directive monitoring	Number of species on the surface unit included in Habitats Directive monitoring	Habitats Directive monitoring	Shapefile with a 10 km polygons	yes	6 years

Source: our elaborations.

vised classification methods or automatic ones. Recognition techniques have been evaluated among a few other for its large application in studies concerning land cover maps production from satellites images, computation efficiency and reliability of the algorithm. Maximum Likelihood Classification (MLC) was preferred in consideration of large use of the technique and the simplified land cover map obtaining procedure. Moreover, MLC is included in the Semi-Automatic Classification Plugin (SCP), a free open-source plugin for QGIS, used in many studies and promoted by ISPRA (Institute for Environmental Protection and Research – Italy).

The derived land cover map from Sentinel 2 data forms the basis on which to carry out the subsequent processing operations. Indeed, it has immediate relevance in the calculation of type 1 HNVFs, through the isolation of the class of meadows and natural pastures and, in the calculation of the index of crop diversity, by calculating the incidence of each of the classes per unit area and the application of the Shannon diversity index formula.

$$H' = -C\sum_{j=1}^{s} p_j \ln p_j$$

where:

- C: constant equal to 1;
- Pj: percentage incidence of the class J surface compared to the total;
- s: number of classes of crop types;
- J: J-th class of crop type.

Although the description of indicators is not the main objective of this article, on the other hand, it is important to explain further the way the process is carried out. We focus on data sources, on the way spatial data are returned and on the territorial scale analysis is referred to.

The modality of data restitution (set the use of georeferenced spatial data as a direct constraint) has conditioned the choice of the calculation methods to be performed in the GIS. This is a crucial step to prepare the methodology. It is important to pointing out that results of the calculation of indicators on a spatial basis can be returned in raster or vector format. The former format requires sizing the fictitious reference cell as an elementary unit of analysis while the latter one presupposes the choice of the elementary territorial minimum figures such as particles, map sheets, farms or municipalities. Each of the two outputs has positive and negative elements that have been carefully evaluated both for the effect they have on analytical choices, and on the outcome, they may have regarding the use of results for public decision-maker use. Of course, while territorial figures like cadastral data are more understandable for decisional and political purposes, the use of raster cells, for which we have opted, albeit fictitious, is a flexible tool with a wide possibility of use. However, it is not excluded the possibility to re-project the results in a discrete form such as cadastral parcels.

Specific spatial elaborations appropriately modified each layer in order to (i) prepare a dataset for our research analysis and (ii) make it compatible with a geographic result as a raster format with a 1000 meters cell (1 square kilometre). The scale of analysis, then the width of the fictitious reference cell for the calculation of the indicators, was chosen to opt for a solution that would allow a fair compromise between time ease of calculation and effective appreciation of the phenomenon to be measured.

The analysis of agricultural systems through FADN and RICA[8] databases presents several positive aspects to identify HNVF areas (especially type 2). These data are regularly updated, which increases their usefulness for monitoring purposes. However, the possible non-representativeness of all agricultural systems potentially affected by HNVF can be observed. The data from the Agricultural Accounting Information Network, RICA, updated annually by CREA[9], provide useful information on the location of the companies' subject to the sample survey and the indication of the levels of each input included in the analysis for each crop. The use of RICA microdata, however, requires a first phase of georeferencing and aggregation on a company basis of agricultural input data by crop type and then an interpolation phase that returns a continuous data on the use of inputs on the investigated agricultural territory. The point data of the farms from RICA survey have been collected according to crop types consistent with the Sentinel 2 land use classes. Afterwards, these point databases have been interpolated through a deterministic technique, the Inverse Distance Weight (IDW), in order to obtain a continuous surface covering the complete regional agricultural territory (Green S., O'Donoghue C., 2013; Fais A. *et al.,* 2005).

The landscape elements from Regional Technical Map instead are submitted to spatial analysis aimed at converting punctual, linear or polygonal vector data into raster. Data used for density calculation of the agricultural landscape elements are represented by the Regional Technical Map in which the punctual features (trees outside forest or isolated trees), linear features (dry stone walls, hedges and tree-lined rows) and the polygonal features (wooded areas) in particular are highlighted. The vicariate nature of these elements imposes the selection of a compensatory aggregation method of the density indexes, since presumably there is an abundance of maximum one of the feature types.

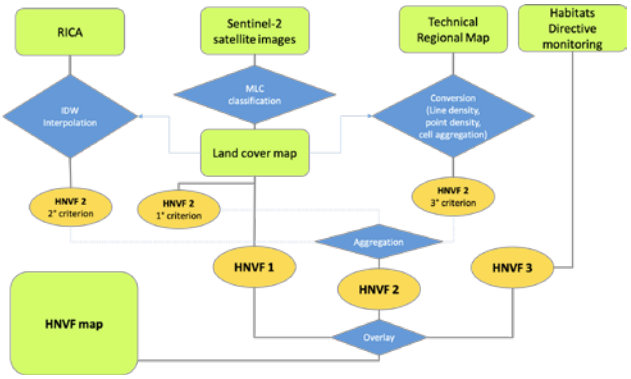
Moreover, the species abundance of conservation concern is measured through the wild species distribution maps deriving from the monitoring of Habitats Directive. It is a 6 years update monitoring, consisting in the distribution of each species in indicative areas with a 10 kilometres grid.

The application of the proposed methodology with GIS on a regional scale requires the use of specific spa-

[8] Agricultural accounting information network.

[9] CREA Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria (Council for Agricultural Research and Economics).

Fig. 3. Processing operations.



Source: our elaborations.

tial processing techniques and conversion procedures to transform satellite images, point databases or geometrically discrete vector data in continuous raster formats. The aforementioned techniques such as MLC for classification of satellite images and IDW for interpolation of point data found in the literature among the most effective and available on commercial and open-source software used for the intended purpose.

Finally, as in the most common multi-criteria analyses, the choice of thresholds represents a crucial, often criticized, topic. In HNVF identification, being an aggregated non-specific index, it is difficult to identify optimal and efficient values, indicative targets or even predetermined thresholds that satisfy the choose criteria. Therefore, we opted for the application of an ordinariness principle, well known in the evaluation and used because of its geographical relativity. Each classification of data and information took place in such a way as to represent the ordinariness of the phenomena diffusion and the particular specificity cases (high natural value).

Figure 3 shows the operational process performed by elaborating the spatial data in order to produce the HNVF types map. These maps can be overlapped to understand the respective distribution, to distinguish the percentage of typological coexistence as well as the qualitative differences between the different areas.

The theoretical framework and the methodology adopted (through a cascade process) have been detailed. Although each passage could be debated or even changed, the framework and the set of choices described have undebatable advantages. It has an instrumental value, built to satisfy a specific need of RDP's: mapping HNVF, tailored to be used over time, systematic way to guide decision-makers and stakeholders towards the goal of determining the solution that best solves the problem.

3. RESULTS

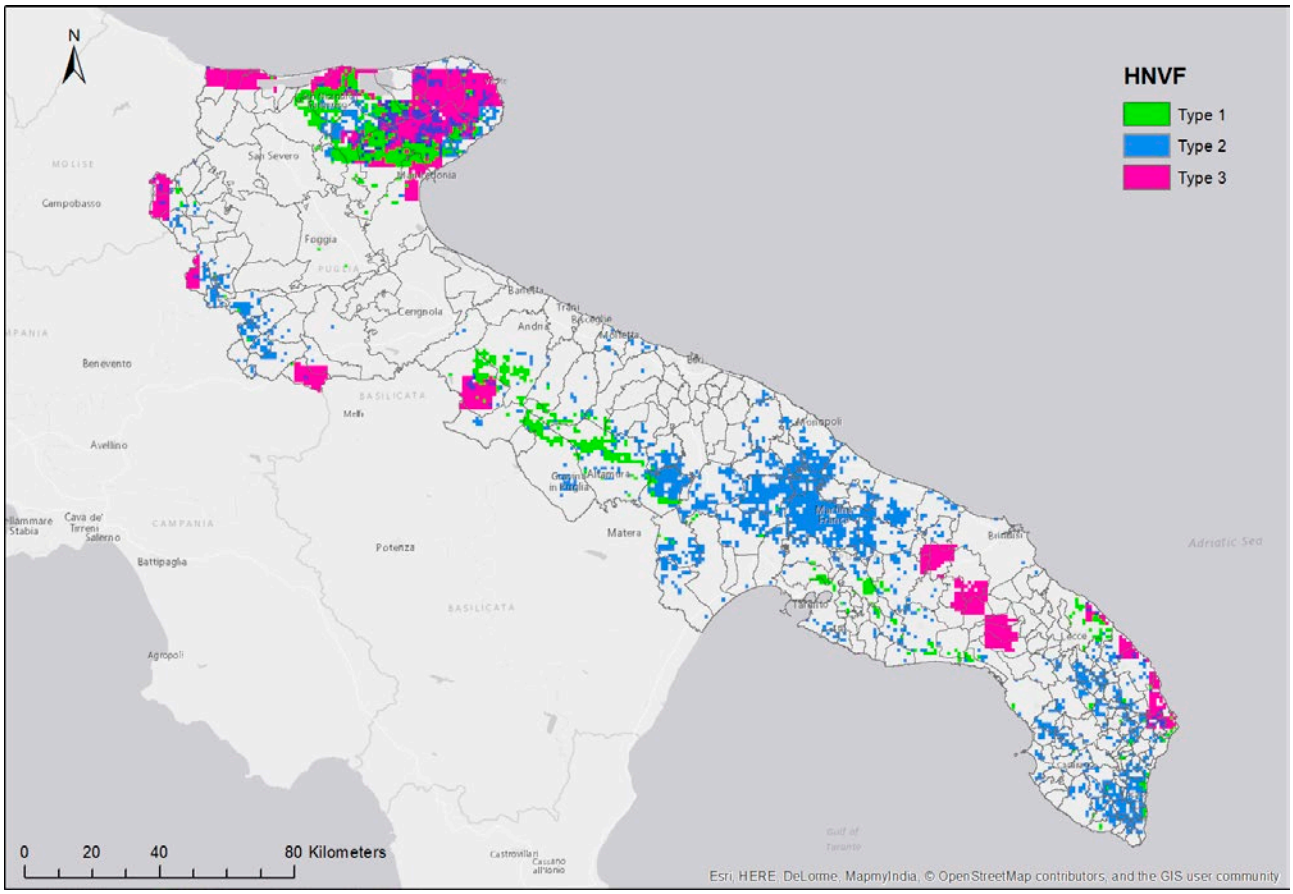
As a result of the application of the above-mentioned methodology, elaborations in Apulia (Italy) are described as follow. The three types of HNVF areas identified by applying the proposed methodology have a respectively territorial extension of 828,00 square kilometres, 2.454,00 square kilometres and 1.721 square kilometres, with a respective territorial incidence of 4.28%, 12.69% and 8.90%. Overall, considering also the areas where two or more types overlap, we reach a total regional endowment of 4,302 square kilometres that represents approximately 22.2% of the regional area classified as HNVF. As shown in the figure (Fig. 4), a prevalence of type 2 emerges, followed by type 3 and type 1. Among the most widespread forms of overlapping, the areas in which type 2 and 3 coexist are 5.70% while type 1 and 3 overlap in 4.50 % of the classified areas.

The selection process identifies some specific core territories where HNVF concentrate, showing an agricultural landscape and cultural system specialization. The central part of the region, known as «Alta Murgia», is classified prevalently as type 1. In the North West area, «Monti Dauni» has been classified as type 2 as well as «Murgia dei Trulli», «Valle d'Itria» in the middle south area and inland Salento in the South. A mixture of typologies, instead, characterizes different territories. Gargano in the upper east part of the Region is a complex of combination of all typologies represented, while coast of Salento is predominantly type 1 and 2 with a few hot spots of type 3, especially near wet retrodunal areas. Some other zones have been excluded by the methodology. Indeed, results highlight how many characters contribute to the effectiveness of the analysis. Some of the excluded areas are affected by agriculture specialization such as olive groove monoculture (central Apulia). Some others reflect the predominance of intensive agricultural systems. As emerges from RICA data analysis, in those specific areas, intensity index associated with the arable lands that represent the prevalent agricultural typology is decisive.

4. DISCUSSION

The study shows an application of an original methodology that derives from the implementation of a theoretical framework with strong connections to Andersen definitions of HNVF and the specific Community guidelines. Results reflect the multidimensional concept underlying HNVF. It lets us reaching a likely amount of areas with high natural value, also coherent with those

Fig. 4. Overlay of HNVF maps.



Source: our elaborations.

results obtained in studies analysed as following and with an internal consistency due to the representativeness of the territories classified in the landscape planning tools used at the regional level.

Comparing this methodology with that applied by the study officially used by regions for identifying HNVF (National Rural Network 2014), many advantages can be underlined. It is clear how the initial difficulty of combining land-use and cultivation intensity approaches on an adequate and homogeneous scale has been overcome. Furthermore, results from the cited study show that maps only have the function of summarily representing the distribution of the HNVF areas in the territory, while the matching numerical value corresponds to the estimate of SAU of each cell divided by the different degrees of natural value. In the National Rural Network study, a research on the different degree of membership to HNVF at a national scale, has been conducted. Starting from the results of this work our analysis focuses on a regional scale. It allows and at the same time deserves a more detailed assessment of such kind of agricultural areas. Moreover, the results obtained in the work of Campedelli *et al.*, 2018 try to validate the report of the National Rural Network, showing attention only towards bird species, leaving behind other animals (mammals and reptiles) or plants. It focuses especially on HNVF type 3 while advances a criticism towards approach on land cover and farming system. Our methodology, instead, aims at including and integrating different approaches. This can guarantee a greater accomplishment of the Helpdesk requests, trying to address each typology with a specific and adequate approach, aware that land cover is essential for type 1, farming system is crucial but not exhaustive for type 2 and species distribution for type 3.

Results appear to be coherent with Apulia territorial characteristics. In particular, a clear division between areas known and classified as separate landscape areas in the Regional Territorial Landscape Plan (PPTR Puglia) have been confirmed. Indeed, territorial charac-

terization deriving from both natural value and type of agriculture conducted in those areas can be easily recognized and overlapped with HNVF typology found with the application of the methodology.

The geographic area known as «Alta Murgia» is prevalently dominated by pastures and poor grassland as well as arable dry land. Here a clear abundance of HNVF type 1 is recorded. Moving from this area to south-east, we encounter a more diversified cultural system, where pasture gives way to orchards, olive groves and vineyards as well as a heavier presence of woods, hedges and anthropic agricultural landscape elements, such as drywalls. This area is well recognized as «Murgia dei Trulli», characterized by the typical agrimosaic of «Valle d'Itria». The application of the methodology in this context is accomplished with a massive selection of areas classified as HNVF type 2, suggesting an appropriate use of thresholds and parameters used in the analysis.

In the north part of the region, two areas were identified as HNVF cores. Passing the «Tavoliere» area, where monoculture and intensive agriculture have been taken into account, leading to a clear exclusion of HNVF concept, as recorded in the results, «Gargano» and «Monti Dauni» are, rightly, subjects to selection. In the former area a net dominance of HNVF type 2 is observed, especially in the southern part. Here, there is marginal agriculture, typical of mountain and inland areas. The same characteristics can be found in the Gargano promontory where also an abundance of mountain and hilly pastures is recorded.

Ultimately, this preliminary application of the methodology leads to a comforting result since the extension of HNVF in Apulia is consistent with what can be found although in the scarce literature. The overall HNVF area is slightly below the results obtained by Trisorio *et al.,* (2013) in which areas potentially classified as HNVF were estimated for Apulia in 40% of the total regional extension, equal to 5,960,00 square kilometres (areas where medium and low potential are also included). The work of the JRC (2008) conducted on the NUTS2 scale; on the other hand, returns lower values, reaching a percentage of 15.9% and a total extension of 2,667,00 square kilometres.

5. CONCLUSIONS

HNVF areas have a rising strategic value for the CAP. In fact, the themes of conservation of agricultural systems with low environmental impact and biodiversity have become an essential part of the Community Agricultural Policy. The multiple references of the Regional, Italian and European Rural Development Programs to the need to rely on a sure data concerning the quantification of HNVFs require particular attention to this topic. With this aim, therefore, a modular instrument that allows identifying HNVF areas has been proposed, based on statistically rigorous methodologies and on data that can be updated over a short period in order to be useful to the public decision-maker. An objective that clashes with two problems of «structural» nature: the scarcity of data that at the same time respect all the requirements suggested by the Helpdesk and the difficulty of integrating geographically surveys with analysis of cropping systems. Technologies behind remote sensing and spatial interpolation have overcome these difficulties, with promising results. Despite the well approved significant role in crop classification and crop monitoring (Steven & Clark, 2013), remote sensing for the assessment of agricultural coverage in order to quantify CAP indicators is still an innovative topic. The EU Regulation no. 746/2018, strongly encourages the use of satellite image interpretation instead or in combination with traditional «on-site» checks, while supporting different methodological alternatives for CAP surface measurements. Furthermore, the combination of satellite data with crop data from RICA sampling survey makes it possible to integrate an approach based exclusively on land use with aspects concerning the management of agricultural inputs in order to identify agricultural systems with different intensities. Finally, the research comes to the mapping of the different types of HNVF in Apulia showing high adaptability for other regions and, using data from different years, to compare the evolution over time. A global amount of about 4.000 square kilometres of farmland areas with High Natural Value have been identified, corresponding to about 22% of the regional surface. The work carried out leads to results that are consistent with those found in the relevant literature and is consistent with landscape plan (PPTR, 2015), the main policy tool for managing territorial transformation at a regional scale.

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Monitoring biodiversity: challenges in High Nature Value farming identification

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Abstract. For its relevance to biodiversity conservation, the preservation and development of High Nature Value farming (HNVf) became one of the strategic priorities of Rural Development Policy. HNVf indicators were therefore included into the Common Monitoring Evaluation Framework. This paper illustrates a method aiming at HNVf identification on the basis of the integration of administrative and territorial data, enriched with qualitative information collected through field survey. By providing a higher level of both territorial detail and HNVf characterisation this method refines previous work undertaken by the Italian Network for Rural Development. Results for a pilot Italian region are described and suitability of the method to assess both other agro-environmental indicators and impact indicators is pointed out.

Keywords: High Nature Value farming, biodiversity, environmental monitoring and impact assessment, land cover, field survey.
JEL codes: Q15, Q18, Q51, Q57.

1. INTRODUCTION

The concept of High Nature Value (HNV) farming was introduced during the early nineties (Baldock *et al.*, 1993; Beaufoy *et al.*, 1994) in order to focus the attention on types of farming, particularly low-input farming, and farmed landscapes that are inherently valuable for biodiversity. It was recognised that the conservation of biodiversity in Europe depends on the continuation of low intensity farming practices across large areas of countryside (Bignal *et al.,* 1994; Bignal, McCracken, 1996; 2000).

According to Andersen *et al.* (2003) HNV farmland (hereafter HNVf) refers to «those areas in Europe where agriculture is the dominant land use and where agriculture supports or is associated with either a high species and habitat diversity or the presence of species of European concern or both».

HNV farming concept evolved in the framework of both the integration of environmental concerns into the Common Agricultural Policy (CAP), and the adoption of the European model of multifunctional agriculture (EEA, 2005; Paracchini *et al.*, 2006; Pointereau *et al.*, 2007; Paracchini *et al.*, 2008;

Beaufoy *et al.*, 2008; European Communities, 2010). Within this framework, HNVf and the associated farming systems have increased their policy relevance and in 2006 their protection and enhancement were included among the strategic priorities and targets of the European Rural Development Policy (European Council, 2006). Consequently, in order to monitor and assess impacts of Rural Development Programmes (RDPs) on biodiversity, HNVf indicators have been included in the Common Monitoring and Evaluation Framework (CMEF) of programming period 2007-2013 (European Commission, 2006), and confirmed in the subsequent programming period as well.

In 2007 each Member State was thus required to provide an assessment of the extent and quality of HNVf, based on the CMEF Handbook (DG Agriculture and Rural development, 2006), while facing the lack of both a common understanding of HNVf concept and a standardized common method. Estimates of HNVf were consequently produced by Managing Authorities following different methods and approaches reflecting the wide variety across Member States of agro-environmental characteristics, farming types and data availability (see for a review Peppiette, 2011; Oppermann *et al.,* 2012; Keenleyside *et al.,* 2014).

Over the past ten years, good progress has been made in HNVf identification as a result of both an increasing understanding of the HNVf concept and continuous work by Member States on improving their methods and data collection, supported by the EU Evaluation Expert Network through specific workshops and two guidance documents (European Communities, 2009; 2010; 2016), and drawing on the parallel work carried out by the European Environmental Agency (EEA, 2012), by European and national institutions (e.g. Paracchini *et al.*, 2008; Pointereau *et al.*, 2007; The Scottish Government, 2011), experts (e.g. Beaufoy, 2008; Oppermann *et al.,* 2012) and academy (see Benedetti, 2017 for a review). From the large scientific and technical debate on HNVf it emerged that, due to wide heterogeneity among Member States, a one size fits-all method it is neither appropriate nor feasible, rather it is appropriate to «use methods suited to the prevailing bio-physical characteristics and farming systems, and based on the highest quality and most appropriate data available (DG for Agriculture and Rural development, 2017) (Peppiette, 2011)».

Currently, wide consensus has been reached on the HNVf conceptual framework: HNVf definitions, typology, and common criteria for identification, are now widely accepted. HNV farming is widely understood as resulting from a combination of land use and farming systems which are related to high levels of biodiversity or the presence of certain species and habitats. Three broad types to be understood without being sharply delimited, based on Andersen *et al.* (2003) and subsequent modifications (Paracchini *et al.*, 2008), came into common usage in describing HNV farmland: Type 1. Farmland with a high proportion of seminatural vegetation; Type 2. Farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers, etc; Type 3. Farmland supporting rare species, or a high proportion of European or World population.

The identification of farmland exhibiting HNV characteristics can be based on three different criteria: land cover criteria, farming system criteria and species criteria. Ideally a combination of criteria, depending on the type considered, should be used (Beaufoy, 2008). In practice, due to data limitation, this approach has demonstrated to be very difficult at level of entire countries or regions (European Communities, 2010).

Broadly, three main approaches are used, depending on type of data available: the land cover approach, based on land cover data; the farming system approach, based on data reflecting farming practices; the species approach, based on species data (Andersen *et al.,* 2003; European Communities, 2010; Keenleyside *et al.,* 2014; see Lomba, *et al.,* 2014 for a review).

In Italy, at the beginning of programming period 2007-2013, HNVf was identified by each Managing Authority based on different interpretations of the concept and using different methods, making it impossible to obtain a clear and homogenous picture at a national level. Therefore, in order to make available a national framework, the National Institute of Agricultural Economics, within the activities of the Italian Rural Network, provided estimates at a national level based on a common method following the EC Guidance documents, and pursuing, in particular, the land cover approach (Trisorio *et al.,* 2013; Rete Rurale Nazionale, 2014). Existing data (with both national coverage and regional geographical detail) influenced the level of detail of estimates. The analysis was based on various sources of territorial data available on a national scale: sample data derived from AGRIT project[1], Corine Land Cover data and Natura 2000 fact sheets. On these three

[1] AGRIT project is a statistical programme carried out by the Italian Ministry of Agriculture, Food and Forestry Policies (Mipaaf) since 1988. It consists of a Point Frame Survey based on a two-phase stratified sampling design aimed at producing national and regional statistics on the surfaces of the main agricultural crops and on some agro-environmental parameters. This was performed by processing data obtained from in-situ surveys on a sample of points randomly selected from a systematic sample of points (Frame AGRIT-POPOLUS).

themes, a geographic information system was created. The assessment referred on a 10x10 km grid (AGRIT cell.), has been based on the presence of low intensity farming and on three criteria derived from the types identified by Andersen *et al.* (2003) and expressed by three indicators: high proportion of semi-natural land cover; mosaic-like landscape; richness of species of conservation interest. The units of analysis, i.e. the cells, were assigned scores combining the scores obtained for each of the three indicators. Estimates were produced on the extent of both the three types of HNVf and the total HNVf, classified by nature value. The limits of this work can be found in the level of geographical detail of results, and in the limited information on management practices intrinsic to the land cover approach (European Communities, 2010). Particularly, land cover estimates, available for the AGRIT cells and derived from sample surveys, do not allow a precise localization of classes of land cover. The latter would require a further detailed territorial characterisation based on geo-referenced data possibly available at regional level.

The aim of the present study, equally realized within the activities of the Italian Network for Rural Development, is the refinement and enhancement of previous work by providing a higher level of both territorial detail and HNVf characterisation. The land cover approach is integrated with a sampling approach capturing information on farming practices/intensity and quality of HNVf, thus producing more robust and realistic HNVf identification (European Communities, 2010; Lomba *et al.*, 2014; Peppiette, 2011; EEA, 2012).

The method has been tested through a pilot for the Piedmont Region, building a specific database based on the integration of administrative and territorial data stored in the National Agriculture Informative System (SIAN), with particular reference to the data from the Integrated Administration and Control System - IACS (including the Land Parcel Information System), and data derived from the AGRIT project, enriched with qualitative information collected through field surveys on sample points statistically selected. The main stages of the proposed approach and a brief overview of outcomes for the study area are provided. The potential application of the proposed approach to RDPs impact assessment on environment and suitability for additional agro-environmental indicators is illustrated.

2. DATA AND METHODS

The research project has been structured in seven stages: 1) structuring of the reference grid linked with the AGRIT-POPOLUS sampling frame; 2) shaping of the spatial data bases on each unit of the square grid; 3) defining the data set for territorial characterization; 4) classification and stratification of each unit of the grid (and frame points); 5) field surveys; 6) statistical elaborations on management practices, landscape and naturalness parameters; 7) identification of «potential» HNVf.

2.1. Structuring the reference grid linked with the AGRIT sampling frame

As mentioned before the method proposed is based on the integration of spatial information, such as administrative and territorial information available from the IACS (i.e. Refresh project[2] and LPIS data, Farm register data) with field surveyed data detected in a sample of geo-referred points in order to collect additional data on management practices and agro-environmental parameters, otherwise undetectable by photointerpretation. The construction of the reference grid had therefore to take into account both the expected level of territorial detail and the point frame adopted for field surveys.

The first stage of the study was, then, the definition of the spatial unit where the information available was to be spatialised, so that the level of geographic detail was higher than previous work based on a square grid of 10x10 km derived from AGRIT project, based on AGRIT-POPOLUS[3] point frame The latter consists of a regular grid covering the entire national territory. Points on the nodes of the grid are spaced 500 meters. Each AGRIT-POPOLUS frame geo-referenced point was stratified according to the following strata: 1. arable land and fodder; 2. permanent crops; 3. permanent grassland; 4. woodland; 5. scattered trees and farm buildings; 6. else (artificial areas, waters, etc.).

For its characteristics the point frame AGRIT-POPOLUS was adopted also in the present study, but, as spatial unit grid, a regular grid consisting of square units of 2x2 km has been adopted as reference. This dimension has demonstrated[4] an acceptable level of detail for

[2] The Refresh project is carried out by the Italian Payment and Control Agency (AGEA). It is aimed at the prior certification of the territorial component of Italian farms and it is based on the photo-interpretation of the land use of the whole national territory. Photo-interpretation is not limited to the parcels declared for agricultural subsidies application, but artificial, natural and forestry is included.

[3] Permanent Observed Points of Land Use Statistics.

[4] The results of the «Pilot Study on the Basilicata Region», funded by the Mipaaf in 2012, show that square units of 2x2 km give an acceptable level of detail for regional level analysis. Aim of the AGRIT – Baseline project was the constitution of a unique baseline, through the integration of the available geographical data, land cover/use data, statistical

regional level analysis. As a result, for the Piedmont Region a grid of 6,692 square units of 2 km per side was obtained. The grid includes 101,516 geo-referred points from the AGRIT-POPOLUS grid.

2.2. Shaping the spatial data bases on each unit of the square grid

SIAN's databases used for integration were:

- Land Cover layer resulting from the Refresh project, consisting in photo-interpretation data of the whole national territory (300,000 sq.km).
- Ecological Focus Areas (EFA) layer of LPIS: landscape features (ponds, groups of trees and groves, ditches and canals, stones walls, hedges and tree row, field margins, terracing, grass margin, isolated trees) detected by photo interpretation;
- Farm register data (farm crops, farm's and farmer's information)
- RDP applications: type of measures applied by farm and associated areas[5];
- Territorial and administrative data (Province boundaries, Municipality boundaries, Natura 2000 areas, etc.).

The «refresh» data were superimposed on the grid enabling the definition of different land cover polygons for each unit of the grid. Subsequently, cadastral parcels falling within the agricultural polygons were identified, allowing the identification of the cultivated crop in each parcel as declared in the farm register. The output of this phase consisted of a database in which for each grid unit the land cover area (possibly detailed at crops level for arable crops) was defined according to the adopted legend[6].

It should be noted that for the boundary units grid the entire area has been considered (400 ha) and not only the area belonging to Piedmont Region.

The reliance on land cover data of high territorial detail made it possible to overcome some acknowledged limitations in HNVf identification (Paracchini *et al.,* 2008; EEA, 2012; European Communities, 2010) improving landscape analysis and the determination of factors of importance particularly in the identification and mapping of HNVf type 2 (Peppiette, 2011).

2.3. Defining the data set for territorial characterization

The characterization aimed to provide an overview of the grid units according to the main classes of land cover (Artificial, Natural and Forestry, Utilised Agricultural Area – UAA, Water) useful for supporting the subsequent process of classification. UAA was further split into sub-classes to be assigned a level of HNV probability (low, unknown, high) according to the peculiarities of local agriculture[7]. Indeed, each territory is characterized by specific types of farming system and cultivated crops that may, or may not, be of potential HNV. Moreover, in the case of the Piedmont Region, we separately considered rice fields, since they are potentially of high nature value (Bogliani, 2008; Travisi & Nunes, 2010; Lupi *et al.,* 2013; Giuliano & Bogliani, 2018). Indeed, under certain farming conditions (to be detected by field survey) they are expected to support a high level of biodiversity

Tab. 1. Data available for each grid unit.

– Natural and forestry areas surface and percentage ratio on the surface of the grid unit
– Natural and forestry areas surface and percentage ratio on the surface of the grid unit
– Artificial areas surface and percentage ratio on the surface of the grid unit;
– UAA surface and percentage ratio on the surface of the grid unit
– EFA surface and percentage ratio on the surface of the grid unit and on the UAA of the unit
– UAA with high probability to be of HNV and percentage ratio on the grid unit
– UAA with unknown probability to be of HNV and percentage ratio on the grid unit
– UAA with low probability to be of HNV and percentage ratio on the grid unit
– Area under rice cultivation and percentage ratio on the UAA
– Surface for which an RDP application has been submitted and share on the surface of the tile
– Average slope
– Surface falling within Natura 2000 areas and percentage ratio on the surface of the unit grid

Figure 1 shows the geographical distribution of the UAA according to the different levels of probability (low, unknown, high) to be of HNV.

data and climatic data to be used as reference for agro-environmental analysis.

[5] Data provided by the Piedmont Region.

[6] The legend derived from a combination of Refresh and farm register classes of land cover.

[7] The assignment of the level of HNV probability was related to the intensity of farming of type of crops based on the usual farming systems occurring in Piedmont Region.

Fig. 1. Distribution of UAA by level of probability of being of HNV (share of UAA of the grid unit).

2.4. Classification and stratification of each unit of the grid (and frame points)

The aim of the stratification was to classify the unit grid according to its level of probability of including HNVf. This, in turn, guided the subsequent selection of the AGRIT sample units characterized by unknown probability of being of HNV (that is, of possible, but uncertain nature value) to be field surveyed in order to detect additional field data useful for assessing the actual nature value of grid units.

The parameters and rules described in Table 2, led to the classification of each grid unit into five categories aimed at guiding the sampling process.

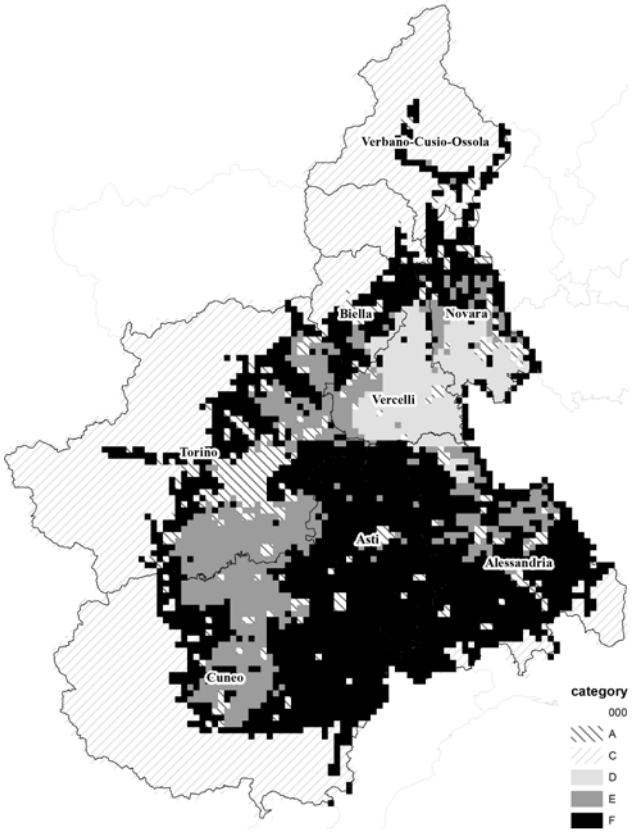
Tab. 2. Categories and respective conditions.

Category	Condition
A	Units where the percentage of artificial areas is greater than *33%* («low probability» to be HNVf)
C	Units above an elevation where UAA is «substantially» of HNV[8]. The elevation was established by the Piedmont Region experts («high probability» to be HNVf)
D	Units where the percentage of rice fields is greater than *33%*
E	Units where the percentage of «low probability» to be HNVf is greater than *33%*
F	Units where the percentage of «low probability» to be HNVf is less than *33%*.

[8] Based on HNVf definition, this category mainly includes permanent grasslands and pastures (farmland with a high proportion of seminatural vegetation), and farmland with a mosaic of low intensity agriculture.

The sample was extracted from the grid units of category D (rice fields % > 33%) and F (percentage of Low probability of HNVf < 33%), which mainly include areas of uncertain, but potential HNV, thus requiring further investigation in order to assign the actual probability of HNV.

Fig. 2. Grid units by category.



The sample was calculated, according to each stratum of the AGRIT-POPOLUS frame points, as described in Table 3.

Tab. 3. Sample calculus.

20% of the AGRIT-POPOLUS frame points classified as stratum 1 (arable crops) included in the grid units of Category D
40% of the AGRIT-POPOLUS frame points classified as stratum 1 (arable crops) included in the grid units of Category F
40% of the AGRIT-POPOLUS frame points classified as stratum 2 (permanent crops) and stratum 5 (Trees out of forest) included in the grid units of Categories D and F
20% of the AGRIT-POPOLUS frame points classified as stratum 3 (permanent grassland) included in the grid units of Categories D and F

The final sample was made up of 9,049 geo-referenced points.

2.5. Field surveys

The purpose of the field surveys was to gather additional information on management practices, landscape and natural characteristics useful to assess the intensity of farming and the level of naturality of farmland, making it possible to detect HNV characteristics linked to farming or farmland.

Parameters to be collected were identified taking into consideration the characteristics of the Piedmont Region's agriculture and so that data can be easily detectable in a quick visit carried out by agricultural engineers/technicians. Parameters to be collected include land cover/land use information as ground truth to qualitatively validate the land cover classification based on SIAN's databases.

Field surveys on the sample points were carried out between April and May 2017. Field surveyors were equipped with an Android-based software package, installed on a tablet, which enabled them to navigate and reach the sample points, enter the data and transmit it in real time.

Quality control of the data collected was performed to assess the survey results and the adequacy of the data for the supporting documentation.

The sampling approach enriched the analysis with information on management practices, landscape and naturalness of vegetation, thus enabling informative gaps of land cover approach to be reduced (European Communities, 2010; EEA, 2012).

Tab. 4. Information collected from field surveys.

All crop classes	Land cover/land use and coverage according to the AGRIT project classification
	presence of stone walls and their maintenance state
	presence of terraces
	presence of hedges and/or tree rows
	presence of water management
Permanent crops	planting pattern (density, regularity)
	management activities: crop conditions (managed/unmanaged); green cover (>50 cm or ≤50 cm) or ploughing
Grasslands	grade of naturalness of vegetation through the identification of key species
Rice fields	state of the land (in dry/submerged)
	presence of water furrows
	presence of grass margins

2.6. Statistical elaborations on management practices, landscape and naturalness parameters

For each square unit land cover types were defined according to combinations of farming intensity, landscape and naturalness parameters.

For this purpose, for all the sampling points, the data of each parameter were generated as follows:

- if at the coordinate point xi (xi represents the coordinate pair of the adopted reference system) the parameter was detected, the observed data was associated with it (value between 0 and 1);
- if at the coordinate point xi the parameter was not found, a null value was associated with it.

The combinations of the different parameters detected for each main land cover class were thus estimated.

To estimate the extent of the area associated with any possible combination of parameters, in the regular blocks of 4 km^2 (square blocks of side 2 km) a local estimation algorithm was used. The applied linear estimator used the information detected in the sampling points around each square unit.

2.7. Identification of «potential» HNV farmland

The identification of potential HNVf was based on land cover agricultural sub-classes associated with specific combinations of landscape, naturalness and farming intensity parameters believed[9] to be favourable to biodiversity, thus conferring HNV features to farmland.

[9] According to literature (Andersen *et al.,* 2003; European Communities, 2010; Oppermann *et al.,* 2012; Lomba *et. al.,* 2014) and expert opinion.

Examples of combinations of field-detected parameters considered for qualifying as HNV the associated land cover classes, are listed below: a) presence of terracing, presence of EFA, low intensity farming (irregular planting distance, no tillage, unmanaged crops) and the presence of green cover for permanent crops; b) presence of water furrows and of grass margin for rice fields; c) the presence of terracing or EFA for cereals, dry pulses and fallow land; while permanent grasslands were considered HNVf regardless of parameters detected.

The presence of irrigation was not given a «a priory» assessment, since its effect on biodiversity is not unique, but it can vary according to the territorial context and the crop considered.

Farmland thus identified, together with the areas previously assigned a «High probability» of being of HNV (thus including permanent grassland), has been used to construct the preliminary database of the potential HNVf in the Piedmont Region.

3. PRELIMINARY RESULTS AND FURTHER STEPS

All the data acquired and processed were structured in a final data base in which for each of the 6,692 unit grids the following data were available:

- land cover data deriving from the SIAN databases (Refresh + farm register);
- land cover surface estimates as a function of the agro-environmental and farming intensity parameters.

The available data for the Piedmont Region made it possible to build a preliminary dataset of potential HNVf in the region identified within the classes of UAA land cover. Graphs and images below show the preliminary results.

As regards the total surface, it should be noted that the databases are built on the entire surface of the unit grid (see § 2.2), therefore for the grid units on the border between two Italian regions, the surface considered was that of the unit grid and not of the regional limit. Vice versa, for the unit grid on the national border, only the surface belonging to the national territory was considered.

It can be seen from Figure 3 that almost half of the UAA exhibits HNV characteristics. The prevailing land cover of HNV is arable crops classifiable as HNVf type 2 «Farmland with a mosaic of low intensity agriculture and natural and structural elements», which are very widespread indeed in the Piedmont Region. It's followed by permanent grassland, classifiable as HNVF type 1 «Farmland with a high proportion of seminatural vegetation».

These results broadly confirm the extent of HNVf and types identified in the previous work (Rete Rurale Nazionale, 2014), but they display greater territorial detail, overcoming one of the main limits encountered in the application of the landcover approach, i.e the coarse spatial resolution of maps produced (e.g. Beaufoy, 2008; European Communities, 2010; Peppiette, 2011). They also incorporate information on the diversity of crops, on management practices and naturalness of vegetation. The first refines the HNVf identification taking explicitly into account the intensity of land management, the second taking into account its conditions.

The method proposed therefore makes it possible to monitor HNVf over time not only in their extent but also in their quality.

The more refined identification of HNVf enables the support of better targeting and tailoring of RDPs measures aimed at maintaining or enhancing biodiversity.

Nevertheless, these preliminary results are subject to further improvement after a process of fine tuning that implies expert opinion based on a careful analysis of maps and parameter combinations. Indeed, HNVf has been identified with a cautious approach, thus providing enough flexibility to allow possible refinements.

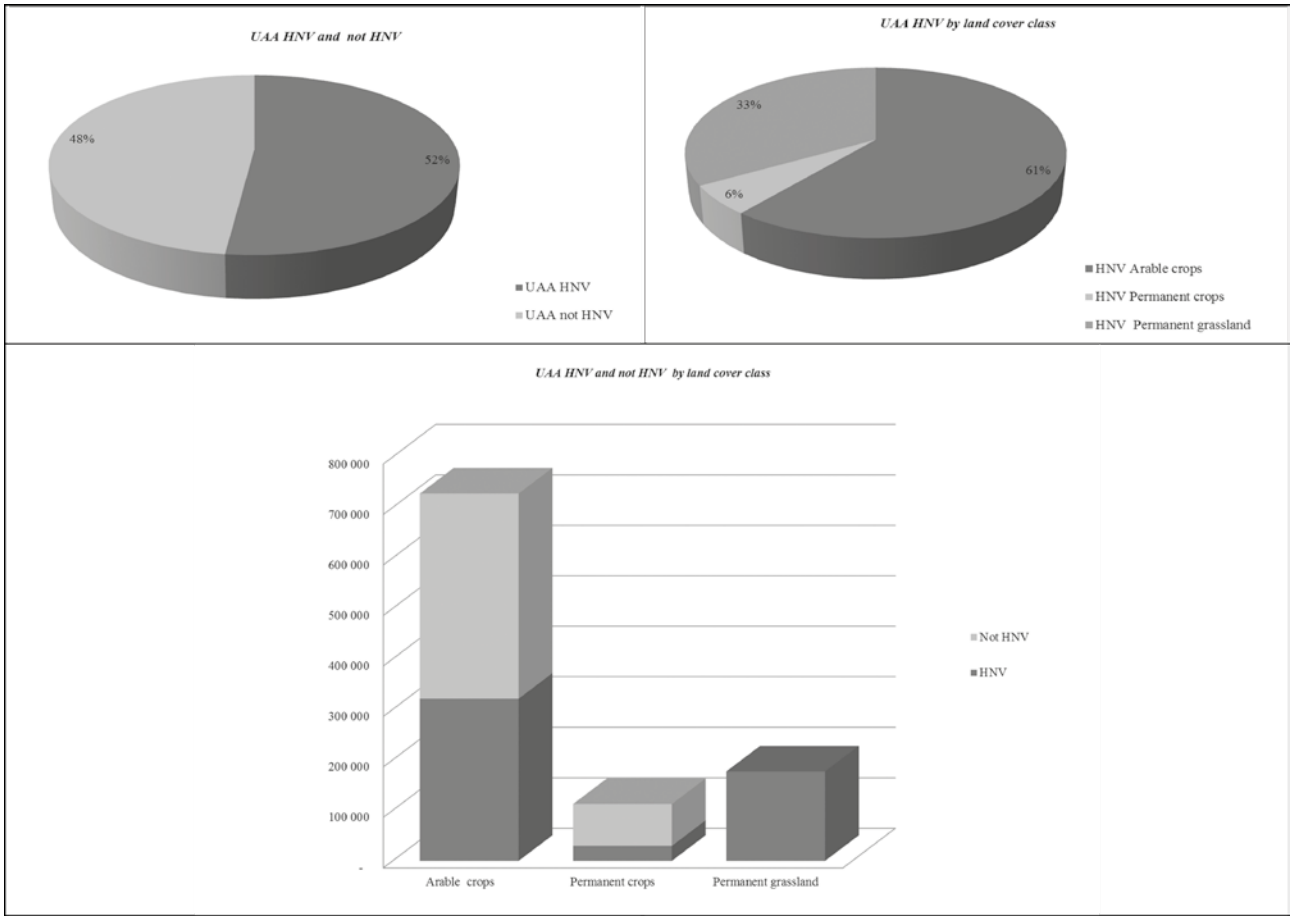
The process of fine tuning will be followed by the classification of HNVf according to different levels of nature value depending on the relevance for biodiversity of each grid unit.

The identification of type 3 «Farmland supporting rare species, or a high proportion of European or World population» will be part of a further stage in the project. It will be based on the integration of appropriate data on biodiversity such as species and habitats (Natura 2000), meadows and permanent grassland species and farmland birds.

4. CONCLUDING REMARKS

HNV farming, resulting from a combination of land use and farming systems which are related to high levels of biodiversity or the presence of certain species and habitats, is region-specific. It follows that the identification and monitoring of HNVf ideally require data with a high level of territorial detail (European Communities, 2010). The operationalisation of the concept has proved problematic for the multiple aspects it comprises (i.e. land use, farming system, species) and subsequent technical and data needs (Beaufoy, 2008; European Communities, 2010). During the last two decades approaches and methods have been driven mainly by type of information categories and data availability, thus only par-

Fig. 3. HNV and not HNV UAA (share and classes of land cover).



tially highlighting HNVf's inherent characteristics (see for a review Oppermann *et al.,* 2012; Peppiette, 2011; Keenleyside *et al.,* 2014; Lomba *et al.,* 2014).

The method proposed relies on the integration of in-situ data, such as LPIS and national orthophotos from the Refresh project, with other administrative and territorial data, providing a detailed characterisation of territory. A further in-depth analysis is provided using qualitative information collected through field surveys on statistically selected sample points. The latter, in turn, made it possible to qualify the territory and, specifically, to detect HNV characteristics exhibited by land units concerning both farming intensity and farmland ecological conditions.

The integration of a land cover approach, based on data of high territorial detail such as the orthophotos from the Refresh project and on a powerful and relevant dataset such as LPIS (Beaufoy, 2008; European Communities, 2010), with a sample approach made it possible to overcome relevant limitations acknowledged in many HNVf identification and mapping exercises (Lomba *et al.,* 2014) and increased the robustness of estimates.

The geodatabase, structured as described above, is suitable for further data integration according to data availability. For example, it can be further enriched by ecological data making it possible to identify type 3 HNVf. The latter will be part of a further stage in the project.

The flexibility of the method presented is such as to enable the integration of additional data layers, thus allowing the improvement of results as new data become available. Most agro-environmental indicators are strictly dependent on land cover and land use features. The characteristics of the proposed method also make it suitable for the development of additional agro-environmental indicators by allowing a detailed characterisation of the territory followed by a field data collection on a statistically selected sample of points to

detect the appropriate[10] parameters. Indeed, it allows us to direct the analysis towards the indicators to be developed.

Additionally, the integration of administrative data (including RDP applications and farm registers) with territorial data, would make the proposed method also suitable for implementing rural development policy impact indicators and assess the effectiveness of specific RDP measures.

Multiple use shows the potential for agro-environmental monitoring and evaluation of the proposed method.

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Short Notes

Le strategie di comunicazione nelle politiche di sviluppo rurale. Alcune implicazioni per la valutazione

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Abstract. Communication is taking on a growing role in European Union policies, especially considering the need to boost transparency and accountability of Operational Programmes. Therefore, the assessment of communication activities has a crucial role in evaluation processes. However, in the last decade few specific evaluations have been carried out in Italian Rural Development Programmes, mostly using desk analysis, customer satisfaction surveys and output indicators. The aim of this study is to review 2007-2013 assessment of communication activities in Italian and European Structural and Investment Funds and to analyse 2014-2020 Italian Communication Plans, to provide useful insights for current evaluations. The analysis suggested the importance of using mixed methods and participatory approaches.

Keywords: sviluppo rurale, informazione e pubblicità, valutazione partecipata, comunicazione pubblica, fondi strutturali e di investimento europei.
JEL codes: G18, Q18, R58.

1. INTRODUZIONE

Le strategie di informazione e pubblicità (SIP) hanno assunto un ruolo crescente all'interno delle politiche comunitarie, in quanto alle stesse è attribuito il compito, da un lato, di garantire pieno accesso ai destinatari del sostegno e, dall'altro, di informare i cittadini dei benefici offerti da tali politiche, anche in termini di produzione di esternalità pubbliche.

Nell'ambito della Politica Agricola Comune (PAC) e, più nello specifico, della politica per lo sviluppo rurale, si è reso imprescindibile l'individuazione di obiettivi chiari e ruoli definiti che conferissero adeguata rilevanza alle attività di informazione e pubblicità dei Programmi.

In tal senso, il Libro bianco su una politica europea della comunicazione (Commissione delle comunità europee, 2006) fornisce una prima individuazione di tre principi fondamentali legati alle strategie comunicative: l'inclusione, la diversità e la partecipazione.

È, tuttavia, con l'attuale periodo di programmazione 2014-2020 e a livello regolamentare che la comunicazione trova una sua più prescrittiva definizio-

ne. In particolare, l'articolo 45 del reg. (UE) 1306/2013 esplicita gli obiettivi di sensibilizzazione verso i contenuti della PAC, che la comunicazione dovrebbe trasmettere ai target individuati dallo stesso regolamento.

Con specifico riferimento al Fondo Europeo Agricolo per lo Sviluppo Rurale (FEASR), è il reg. (UE) 1305/2013 all'art. 66 a stabilire l'obbligo per le Autorità di Gestione (AdG) di dare pubblicità al Programma, mentre le modalità applicative sono definite nell'art. 13 del reg. di esecuzione (UE) 808/2014 e nell'Allegato III, laddove si esplicitano i contenuti fondanti delle SIP dei singoli Programmi di Sviluppo Rurale (PSR), declinate operativamente nei Piani di Comunicazione (PdC).

Nonostante il riconosciuto ruolo strategico, le caratteristiche proprie della comunicazione ne rendono particolarmente difficile la misurabilità e, di conseguenza, la valutazione, soprattutto dei risultati e degli impatti.

In quest'ottica potrebbe leggersi la limitata attenzione rivestita nelle attività di valutazione della precedente programmazione per lo sviluppo rurale da tale aspetto trasversale che, solo per alcuni Programmi, è stato oggetto di una specifica domanda valutativa da parte delle AdG dei PSR italiani[1].

Il presente lavoro si inserisce nel contesto delle attività di monitoraggio e valutazione delle politiche comunitarie ed affronta, attraverso la lettura delle esperienze (nazionali e comunitarie) relative alla programmazione dei Fondi strutturali 2007-2013, un ambito valutativo complesso ed ancora relativamente poco indagato. In particolare, lo studio è stato disegnato per dare risposta alle seguenti questioni:

- Qual è lo stato dell'arte sulla valutazione degli interventi di informazione e comunicazione nell'ambito delle politiche di sviluppo rurale?
- Sotto il profilo valutativo, quali indicazioni trarre dalla lettura delle SIP presentati per i PSR 2014-2020?

Nel complesso, le attività svolte hanno consentito agli autori di addivenire, da una parte, alla definizione di un quadro nazionale ed europeo sulla valutazione degli interventi di informazione e comunicazione nell'ambito delle politiche di sviluppo rurale, e di fornire, dall'altra, utili indicazioni metodologiche per la valutazione delle SIP.

Si riporta in breve l'articolazione dello studio, che, oltre all'introduzione ed agli elementi di discussione finale, è stato strutturato intorno a quattro capitoli. Nella prima parte (Cap. 2), viene affrontato, seppur in maniera sintetica, il tema della valutazione della comunicazione pubblica e della sua complessità valutativa.

Il Capitolo 3 dettaglia la parte dedicata ai materiali e metodi usati nel presente lavoro, incentrato sull'analisi documentale. Consapevoli degli scarsi riferimenti in letteratura sul tema della valutazione della comunicazione e del maggior peso rivestito dalle «esperienze pratiche», attraverso la *review* di alcuni Rapporti di valutazione realizzati nell'ambito dei Fondi strutturali 2007-2013 (Cap. 4), vengono argomentate le scelte metodologiche approntate per valutare la comunicazione pubblica in diversi contesti regionali/programmi.

Infine, nell'ultima parte, sulla scorta delle valutazioni esaminate e tenuto conto del dettato europeo sulla necessità di una buona comunicazione e della sua valutazione per il 2014-2020, gli autori formulano alcune raccomandazioni rivolte, in primis, alle Amministrazioni regionali per il miglioramento delle strategie di comunicazione.

2. CENNI TEORICI SULLA VALUTAZIONE DELLA COMUNICAZIONE PUBBLICA

A partire dai primi anni duemila la letteratura sulla valutazione della comunicazione si è progressivamente arricchita di elementi di riferimento, molti dei quali, come rilevato da Bezzi (2001, 2010, 2011)[2], provenienti dall'esperienza sul campo. Si tratta, tuttavia, di un ambito valutativo complesso e ancora poco indagato. Si consideri, in tal senso, che non è facile neanche proporre una definizione onnicomprensiva di comunicazione e che a seconda delle diverse discipline si possono privilegiare diversi intendimenti.

La cosa si complica ulteriormente se dalla comunicazione in generale si passa al tema specifico della comunicazione pubblica (CP)[3].

Prima di entrate nel merito della questione appare opportuno fornire una definizione del concetto di comunicazione che, come rappresentato nella Figura 1, avviene tra l'emittente (il messaggio) e un suo destinatario.

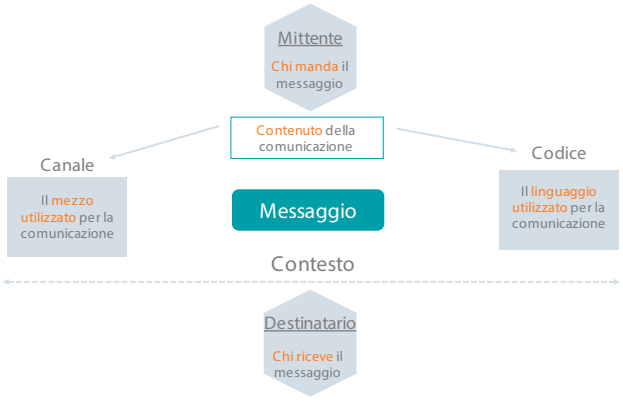
In estrema sintesi, gli elementi fondamentali della

[1] Per approfondimenti si rimanda a Licciardo e Carta (2017).

[2] Tra i valutatori italiani è l'autore che maggiormente ha contribuito al tema.

[3] Mancini (2006), nel suo «Manuale di comunicazione pubblica» distingue tre diverse tipologie di comunicazione pubblica o istituzionale: 1) dell'istituzione pubblica: è quella proveniente dalle istituzioni pubbliche, finalizzata a renderne note le attività e le funzioni, promuoverne l'immagine e la comunicazione normativa, il cui scopo è quello di far circolare le decisioni, prevalentemente legislative; 2) politica: proveniente dalle istituzioni pubbliche e dai partiti o dai movimenti, incentrata su contenuti che hanno lo scopo di costruire consenso; 3) sociale: proveniente dalle istituzioni pubbliche, semipubbliche o private con lo scopo di sensibilizzare l'opinione pubblica circa problemi sociali riconosciuti da tutti e le cui soluzioni, in via di principio, sono condivise.

Fig. 1. I principali elementi della comunicazione.



Fonte: nostre elaborazioni da Mancini (2006) e Zanacchi (2002).

Fig. 2. Le caratteristiche della comunicazione linguistica.

Fonte: nostro adattamento da Bezzi (2011).

comunicazione[4] sono: il mittente, il destinatario, il messaggio, il codice, il canale e il contesto. Il mittente codifica un messaggio che viene veicolato attraverso un canale e decodificato dal soggetto che lo riceve (destinatario). Il messaggio viene reso attraverso l'uso di uno o più codici (verbale, para-verbale, non-verbale, visivo) nell'ambito di un determinato contesto, lo spazio comune all'interno del quale si collocano emittente e destinatario. Proprio quest'ultimo non è mai un semplice interlocutore, ma un soggetto coinvolto in un'attività complessa, chiamato ad aprire un contesto comunicativo[5].

Senza volersi addentrare troppo in questioni teoriche sulla CP, nel presente lavoro con tale termine ci si riferisce alla comunicazione che le Pubbliche Amministrazioni indirizzano ai cittadini e che, in base a quanto introdotto con la Legge 150/2000, «si identifica con quello specifico esercizio che rende pubbliche le attività e le funzioni dell'amministrazione, sostenendone l'identità e favorendo il consenso dei cittadini su argomenti di interesse collettivo». La CP riguarda, quindi, gli interessi generali della comunità ed esula dall'area del profitto o degli interessi esclusivamente privati (Zanacchi, 2002). Al contempo, la CP implica anche una funzione di verifica della comprensione di quanto comunicato e di ascolto di quelle che sono le esigenze specifiche dei cittadini.

Al fine di meglio inquadrare l'argomento sotto il profilo valutativo, occorre introdurre il tema della complessità della comunicazione dovuta, in particolare, alla molteplicità di attori presenti e alla natura delle relazioni che tra loro si instaurano. Bisogna altresì precisare che si tratta esclusivamente di una comunicazione linguistica[6]: «tutti i processi intenzionali pubblici si basano sul linguaggio. Piani Operativi, progetti, delibere, bandi pubblici, informazioni, circolari, avvisi, ordini di servizio, sono linguaggio» (Bezzi, 2017). Tale aspetto rende difficile una valutazione, se affrontata esclusivamente con strumenti linguistici, in quanto il linguaggio, che rappresenta l'oggetto di analisi, viene indagato con strumenti linguistici tipici della ricerca sociale (disegno della ricerca, tecniche, procedure, ecc.). A differenza di altri oggetti valutativi, infatti, la comunicazione linguistica presenta le caratteristiche dell'immaterialità, della negoziabilità e della vaghezza (Fig. 2). Inoltre, è proprio nella valutazione della CP che tali proprietà si trovano in maniera consistente. In altri termini, il problema di fondo di quando si valuta la comunicazione – cosa che, ad esempio, non accade quando si valutano i risultati di un Programma – è dato dall'evaluando stesso: la comunicazione.

Parafrasando quanto riportato da Bezzi (2011), la valutazione della CP dovrebbe esaminare:

- quanta comunicazione è stata fatta, come e con quali costi;
- se il messaggio è stato indirizzato in maniera adeguata, ovvero con completezza e senza sprechi, al target previsto (efficacia interna della comunicazione). La completezza e l'assenza di sprechi richiamano altresì il concetto di efficienza, nel senso che il messaggio deve riguardare esclusivamente i soggetti del target individuato;

[4] Roman Jakobson (2002), nella teoria delle funzioni del linguaggio verbale, assegna a ciascun elemento del linguaggio una particolare funzione (espressiva, conativa, fatica, referenziale, metalinguistica poetica), che si manifesta nelle forme e nei contenuti del messaggio.

[5] Capire e interpretare il contesto all'interno del quale avviene la comunicazione ha importanza soprattutto quando si parla di comunicazione pubblica.

[6] Il linguaggio è il sistema di segni e/o segnali, retto da un codice funzionale alla comunicazione, che consente di comunicare il pensiero, in quanto gli fornisce una forma comprensibile. Tale concetto si applica sia ai modi di comunicare umani (verbali, non verbali, ecc.), sia al modo di comunicare degli esseri viventi in genere (Peroni, 1999).

- (rispetto al target previsto) in quanti hanno effettivamente compreso la comunicazione. Non è sufficiente che il messaggio sia arrivato ai destinatari, ma lo stesso deve essere stato adeguatamente compreso dagli stessi (efficacia esterna della comunicazione);
- se l'informazione, oltre ad essere stata compresa, ha comportato un cambiamento (in senso lato) nel target, una sorta di presa di coscienza delle opportunità (in generale fornita dal Programma) e dalla conseguente scelta di coglierla o non coglierla, con riferimento alla situazione del singolo soggetto[7].

Tali aspetti manifestano difficoltà metodologiche crescenti che richiedono l'acquisizione da parte della PA di strumenti sia per una più corretta ed efficace competenza comunicativa, sia per una capacità valutativa in merito alla costruzione dell'informazione, alla sua erogazione, all'analisi del feedback e, infine, all'efficacia complessiva del Programma.

Stante le proprietà della CP e la difficoltà di esaminarla con strumenti esclusivamente linguistici, ci si potrebbe chiedere perché valutarla in un ambito specifico come quello dello sviluppo rurale?

In generale e senza pretesa di esaustività, ci sono almeno cinque ragioni per valutare le azioni di informazione e pubblicità dei Programmi, valide, quindi, anche per le strategie di comunicazione dei PSR (Carta *et al.*, 2017):

1. analizzare gli esiti delle azioni di comunicazione permette di identificare quali attività hanno funzionato bene e quali dovrebbero essere migliorate al fine del perseguimento degli obiettivi fissati in ex ante;
2. esaminare i *feedback* dei destinatari aiuta a capire, e meglio interpretare, la risposta ai messaggi trasmessi, individuare quali strumenti funzionano bene e quali attività potrebbero necessitare di correttivi;
3. in un'ottica di *knowledge driven* (Cristiano, 2013), la valutazione della comunicazione consente di apprendere consapevolmente dall'esperienza in quanto produttrice di conoscenza per tutti gli attori coinvolti;
4. consente ai decisori di misurare il contributo che la strategia di comunicazione apporta al perseguimento delle priorità del Programma;
5. permette di rendere conto al largo pubblico delle risorse finanziarie impiegate e giustificarne i benefici.

3. MATERIALI E METODI

Il lavoro, che ha una natura prettamente tecnica, si prefigge l'obiettivo di fornire un contributo alla conoscenza della valutazione delle attività di informazione e pubblicità delle politiche comunitarie, in particolare nel campo delle politiche di sviluppo rurale. L'analisi svolta si basa, principalmente, su un'ampia analisi documentale. A tal fine è stata avviata una preliminare acquisizione di informazioni da indagine desk condotta, in maniera puntuale, sui documenti ufficiali dei Programmi regionali, linee guida comunitarie, letteratura disponibile e – con l'obiettivo di internalizzare le lezioni della programmazione 2007-2013 – Relazioni Annuali di Esecuzione e Rapporti di valutazione dei programmi delle politiche di coesione, nonché della politica di sviluppo rurale. A parere degli autori, infatti, una riflessione esaustiva sul tema della valutazione della comunicazione non può prescindere da un esame della letteratura e delle esperienze realizzate, non soltanto in ambito di sviluppo rurale, ma anche, più in generale, negli altri Fondi strutturali.

La scelta dei Rapporti di valutazione non ha la pretesa di fregiarsi dell'attributo della completezza, ed è stata principalmente guidata dalla disponibilità di documentazione di dettaglio che consentisse una disamina delle tecniche impiegate per la valutazione delle attività di comunicazione realizzate.

Tale limite non inficia però l'obiettivo perseguito, ovvero quello di riflettere sulla valutazione della comunicazione nell'ambito di diverse politiche e programmi, concentrando il focus soprattutto sulle tecniche e sugli strumenti impiegati. Più nel dettaglio, sono stati esaminati 17 Rapporti di valutazione, 9 dei quali attengono alla comunicazione di Programmi operativi (PO) del Fondo Sociale Europeo (FSE), del Fondo Europeo per lo Sviluppo Regionale (FESR), del Programma operativo nazionale (PON) Assistenza Tecnica e del PO Competitività, appartenenti a Regioni italiane e ad altri Stati Membri dell'Unione Europea (UE). Particolare attenzione è stata rivolta alle analisi valutative realizzate nella politica di sviluppo rurale. Nello specifico, sono riportati i principali elementi di valutazione degli 8 Rapporti di valutazione delle attività di comunicazione dei PSR di Galles, Scozia e Finlandia, nonché di quelli disponibili a livello nazionale, ovverosia dei PSR Sardegna, Campania, Lazio, Veneto e della Rete Rurale Nazionale (RRN)[8].

[7] Su tale aspetto può essere utile riportare un esempio proposto dallo stesso Bezzi in un suo lavoro recente (2017): «se comunichiamo opportunamente un bando, ci aspettiamo che parte del target vi partecipi; ma anche chi non partecipa, se è stato adeguatamente informato, ha considerato l'opportunità, l'ha confrontata con la propria situazione». In altri termini, se il bando sarà stato adeguatamente comunicato dovrebbe parteciparvi solo il target-group che presenta le caratteristiche pertinenti.

[8] La RRN è un Programma che accompagna e integra tutte le attività legate allo sviluppo delle aree rurali per il periodo 2014-2020, che, sotto la responsabilità del Ministero delle Politiche Agricole, Alimentari e Forestali, ha l'obiettivo di supportare le politiche di sviluppo delle aree rurali, favorendo scambi di esperienze e conoscenze tra i diversi *stakeholder*.

Gli aspetti più teorici e il quadro generale delle SIP e dei PdC dei PSR 2014-2020, infine, hanno rappresentato il punto di partenza per una riflessione su percorsi di metodo per la valutazione delle strategie adottate nell'ambito dello sviluppo rurale, che possono conciliarsi con le nuove tecnologie e i nuovi strumenti comunicativi messi in atto dalle diverse Amministrazioni regionali. I dati presentati sono frutto di una specifica analisi effettuata dagli autori sulle strategie di informazione e pubblicità dei PSR 2014-2020 delle regioni italiane.

4. VALUTAZIONE DELLA COMUNICAZIONE NEI FONDI STRUTTURALI 2007-2013

4.1. Review di alcune esperienze nella politica di coesione

L'osservazione di quanto realizzato negli altri fondi comunitari rappresenta un fondamentale elemento di completezza conoscitiva e uno strumento di apprendimento da esperienze potenzialmente trasferibili allo sviluppo rurale.

I casi individuati mostrano una comune commistione tra metodologie quantitative e qualitative, calibrate con la finalità di restituire informazioni sulle opinioni e le percezioni dei principali *stakeholder* (grande pubblico, beneficiari effettivi e potenziali, pubblico interno).

Per il reperimento dei dati cosiddetti primari, cioè raccolti attraverso attività sviluppate dal valutatore, le tecniche maggiormente impiegate hanno riguardato, a seconda della tipologia e della numerosità della popolazione[9], sia indagini *face-to-face* che *survey* con metodo CATI, CAWI e CAPI[10].

Tra le tecniche di indagine di natura qualitativa utilizzate, anche i focus group hanno avuto un peso rilevante e hanno consentito un coinvolgimento diretto e facilitato sia dei funzionari pubblici che dei soggetti beneficiari. Seppure non appartenenti alle tecniche valutative, è menzionabile l'utilizzo di metodi quali il *mistery client*[11] per la valutazione delle informazioni fornite tramite gli infopoint e il tracciamento oculare per la valutazione della fruibilità del sito web, entrambi effettuati per il PO FESR Kujawsko-Pomorskie Voivodeship (Polonia).

Dalle valutazioni esaminate è emerso un utilizzo considerevole di *survey*, che possono essere considerate una utile fonte di dati quantitativi e qualitativi, ma che talvolta presentano una bassa possibilità di generalizzazione, considerato il loro stretto legame con il contesto di riferimento (Roccato, 2008).

Inoltre, un limite riscontrato in talune tecniche utilizzate nei rapporti di valutazione analizzati, attiene alla loro vicinanza ad indagini di *customer satisfaction* più che a metodologie valutative propriamente dette.

Oltre ciò, si deve sottolineare la mancanza di una articolazione e schematizzazione del quadro degli indicatori utilizzati, presente soltanto nei documenti relativi al PON Assistenza tecnica Repubblica Ceca (Naviga 4 s.r.o., 2011) e al PO FESR della Spagna (Regio Plus Consulting, 2011). Negli altri rapporti la valutazione è stata, per lo più, guidata dai quesiti posti nelle interviste o nei sondaggi effettuati. Questo, tuttavia, non limita il livello di esaustività di alcune valutazioni. Ad esempio, il rapporto di valutazione sulle attività comunicative del PO FSE Świętokrzyskie Voivodeship (Polonia) (Pracownia Badań i Doradztwa Re-Source, 2010) fornisce un quadro di dettaglio di diversi aspetti, inclusa la congruità delle risorse umane dedicate dall'Amministrazione competente e una analisi SWOT contenente i punti di forza, di debolezza, le opportunità e le minacce delle attività di comunicazione attuate. Da mettere in risalto, altresì, la presenza nella valutazione del PO FESR Basilicata (NRVVIP, 2011) di una nutrita analisi del contesto socioeconomico regionale, con particolare riferimento alla situazione dei canali di comunicazione.

Per quanto riguarda gli altri PO nazionali si ritiene utile sottolineare la periodicità delle analisi valutative svolte nel PO Competitività Lombardia (Gruppo CLAS, 2010). L'inserimento della valutazione della comunicazione nel Rapporto annuale di valutazione ha consentito un accompagnamento vero e proprio dell'attuazione del PdC ed un *follow-up* (Cagliero *et. al*., 2017) continuo, di cui hanno beneficiato le stesse attività comunicative.

In termini di integrazione dei fondi, risalta il tentativo di un PdC integrato tra PO FESR e PO FSE della Valle d'Aosta (Gruppo CLAS, 2011), accompagnato da una valutazione unitaria. In questo caso, il valutatore ha operato una meta-valutazione (Bustelo, 2002) delle indagini che le AdG dei due programmi hanno realizzato per esaminare costantemente l'efficacia delle azioni di comunicazione.

Nel PO FSE Piemonte (ISRI, CERIS, 2012, 2015) *è stata realizzata una analisi quali-quantitativa attraverso questionario, somministrato con metodo CATI, rivolta ai beneficiari dei placement*; l'attività è stata accompagnata da interviste a testimoni privilegiati, soprattutto soggetti coinvolti nell'attuazione del Programma.

Infine, la valutazione della comunicazione del PO FESR Friuli Venezia Giulia (Ecoter, 2010) si caratterizza

[9] Perlopiù sono state realizzate rilevazioni campionarie.

[10] I metodi CATI, CAWI e CAPI sono metodologie di raccolta dati utilizzate nelle indagini statistiche (ISTAT, 2017).

[11] La tecnica del *mistery client*, mutuata dal marketing, viene utilizzata per la valutazione della qualità di un servizio erogato. Consiste nella creazione di situazioni realistiche da parte di un fruitore che viene istruito, con l'intento di valutare un servizio del quale finge di voler beneficiare.

Tab. 1. Quadro sinottico sulle tecniche valutative usate nei casi studio della politica di coesione.

Valutazione	Analisi desk	Questionario	Intervista*	Focus group	Analisi SWOT	Mistery client	Customer satisfaction
PO FSE Świętokrzyskie Voivodeship** (Polonia)	x	x	x		x		
PON Assistenza tecnica Repubblica Ceca	x	x	x				
PO FESR Spagna		x	x	x			
PO FESR Kujawsko-Pomorskie Voivodeship (Polonia)	x	x	x	x		x	
PO FESR Regione Basilicata	x	x	x				
PO Competitività Lombardia	x	x	x				
PO FESR e PO FSE Valle d'Aosta	x	x	x	x			x
PO FSE Piemonte	x	x	x				
PO FESR Friuli V.G.	x		x	x			x

(*) comprende interviste realizzate con metodo CAPI, CATI, CAWI, in profondità a stakeholder privilegiati; (**) il voivodato è il primo livello della suddivisione amministrativa della Polonia.
Fonte: nostre elaborazioni su rapporti di valutazioni 2007-2013.

per l'impiego di un mix di tecniche di indagine: interviste telefoniche destinate a cittadini e rappresentanti di enti locali; focus group con i rappresentanti delle organizzazioni imprenditoriali; interviste semi-strutturate e in profondità al responsabile del PdC e ai componenti interni ed esterni del team di comunicazione.

Al fine di confrontare le tecniche utilizzate e gli approcci metodologici seguiti, nella Tabella 1 vengono riportati gli elementi essenziali delle valutazioni selezionate.

4.2. Review di alcune esperienze nella politica di sviluppo rurale

Sul fronte dello sviluppo rurale sono otto i Rapporti di valutazione oggetto di approfondimento: tre prodotti in altri Stati Membri e cinque nazionali.

Come già detto, le valutazioni considerate a livello europeo sono riferite alle SIP realizzate a valere sui PSR di Scozia, Finlandia e Galles. Similmente a quanto rilevato in precedenza, anche lo sviluppo rurale si caratterizza per un ampio uso di interviste e sondaggi, talvolta assimilabili a vere e proprie *customer satisfaction*.

In Scozia, l'attività ha riguardato congiuntamente la comunicazione nell'ambito del PSR e del Programma RRN (Scottish Government Social Research, 2013). Focalizzando l'attenzione unicamente sul primo, si rileva la suddivisione tra i due «flussi comunicazionali» (Klein-Dossou, Fava, 2001), quello interno e quello esterno, nonché la particolare rilevanza assunta dall'approccio LEADER[12] per l'attuazione degli interventi di sviluppo locale, non esplicitamente richiamato negli altri rapporti di valutazione esaminati. Nonostante la completezza dell'analisi, lo stesso documento evidenzia il limite rappresentato dagli indicatori stabiliti nel PdC, vaghi e spesso difficilmente calcolabili a causa del sistema di monitoraggio adottato dal Programma.

Nel rapporto di valutazione della Finlandia (Lyra, 2014) viene sottolineato il forte orientamento alla Programmazione 2014-2020. In un'ottica di *lesson learned*, le risultanze valutative sono, infatti, interpretate come un valido punto di partenza per la formulazione di una strategia di comunicazione che consideri criticità e punti di forza del passato.

La valutazione della comunicazione nel PSR Galles (Cazbah & Miller Research, 2012), infine, conferma l'utilizzo di interviste e *survey online*, ma non si limita a rivolgersi agli *stakeholder* esterni comprendendo anche l'importanza di quelli interni. Inoltre, si individuano casi di successo della comunicazione (sia nazionali che regionali) e buone pratiche comunicative provenienti da altri Stati Membri.

Con riferimento alla situazione nazionale, i materiali considerati comprendono le poche valutazioni che hanno avuto come oggetto le azioni di comunicazione. Le sole Regioni ad avere effettuato un approfondimento valutativo dedicato alle strategie di comunicazione sono, infatti, tre: Lazio, Veneto e Sardegna. A queste si aggiun-

[12] Dal 1989, il LEADER (*Liaison Entre Actions de Développement de l'Économie Rural*) è un approccio allo sviluppo locale nell'UE sulla base delle esigenze e delle potenzialità di territori rurali ben definiti, di livello subregionale.

ge la Regione Campania (Assessorato Agricoltura Regione Campania e DigitCampania, 2014) che ha realizzato un dettagliato rapporto di valutazione tramite la società in house di informazione e comunicazione e il rapporto di valutazione della comunicazione del Programma RRN.

Passando alla disamina puntuale degli output realizzati, il PSR Sardegna (ISRI, 2015) si contraddistingue per l'utilizzo della sola analisi *desk* come tipologia di analisi. Nel dettaglio, la valutazione si è basata sulla documentazione relativa al PdC ed alla sua attuazione; sui dati di monitoraggio degli strumenti diretti ai diversi destinatari previsti nel Piano; sull'analisi degli accessi al sito internet dedicato e degli utenti dei social network; sui dati riferiti alla partecipazione ai tavoli tecnici, workshop/seminari/convegni; sulle risultanze derivanti dall'utilizzo dei media tradizionali (pubblicazioni e materiali audiovisivi; articoli su stampa e inserzioni pubblicitarie sui quotidiani; spot televisivi e radiofonici; etc.); infine, sui dati di monitoraggio del servizio di *help-desk* (ISRI, 2015). La ricchezza delle fonti documentali utilizzate deriva dall'elevato numero di attività comunicative realizzate dalla Regione e si riflette nell'impiego di una nutrita batteria di indicatori che, tuttavia, esprimono fondamentalmente informazioni sul realizzato.

La valutazione della comunicazione del PSR Veneto (Agriconsulting, 2010) si è articolata in una analisi dei dati di monitoraggio, accompagnata dalla somministrazione di questionari ai beneficiari delle principali misure del Programma e sondaggi online, svolti attraverso un mailing mirato al grande pubblico. Con un questionario di autovalutazione somministrato ai Gruppi di Azione Locale (GAL) *è stato, inoltre, effettuato uno specifico focus sul ruolo dell'approccio LEADER nel contribuire alla comunicazione del PSR*.

Le interviste dirette e telefoniche sono state le tecniche per la valutazione del PdC del PSR Lazio (Agriconsulting, 2013). Tali interviste hanno riguardato i tre target principali della comunicazione (beneficiari del PSR, potenziali beneficiari e testimoni privilegiati) individuati con il contributo della Regione.

Nella valutazione della RRN (Ecosfera VIC, 2010), il tema della comunicazione è stato oggetto di numerosi focus da parte del valutatore indipendente, anche in considerazione del ruolo cardine rivestito dalle SIP nell'ambito dei Programmi di rete. L'approccio che ha caratterizzato la valutazione on-going ed ex post della RRN, inclusa la comunicazione, è stato quello di una «valutazione partecipata», basata cioè sul pieno coinvolgimento dell'AdG e degli altri attori del programma nel processo valutativo. Numerose sono state le tecniche di analisi adottate, che hanno spaziato dalle indagini dirette presso le Amministrazioni dei 21 PSR regionali e gli altri stakeholder, alle indagini di customer satisfaction (con specifico riferimento al sito internet e agli eventi realizzati), ai questionari di autovalutazione rivolti alle strutture operative della RRN (Task Force e Postazioni regionali), agli studi di caso e al brainstorming valutativo utilizzato dal valutatore per far emergere nuove idee all'interno del gruppo di lavoro della valutazione. La complessità del Programma e la sua composita articolazione hanno richiesto un particolare sforzo valutativo che trova la propria espressione quantitativa nel calcolo di una serie di indicatori di realizzazione, risultato e impatto, adeguatamente correlati al Programma e rispondenti ai criteri SMART[13]. Completano la valutazione della RRN alcuni focus su specifiche attività di comunicazione quali: i) il portale internet, valutato attraverso l'utilizzo di una griglia di criteri riferiti allo strumento di Analisi sui Siti Web dei Programmi Operativi (ASPO) che *è* un metodo di controllo automatico per la conformità ai requisiti tecnici di accessibilità; ii) il blog del progetto «Rural4Kids»; iii) il progetto «Eccellenze Rurali», e iv) il progetto «Nuovi fattori di successo».

Merita, infine, particolare menzione la valutazione della comunicazione del PSR Campania, quale esempio sia per la diversificazione nelle metodologie adottate, sia per il *delivery* dei risultati valutativi, restituiti con una grafica comunicativa efficace. Le numerose tecniche utilizzate (analisi documentale, indagini con metodo CATI, CAWI, CAPI, focus group, questionari interattivi con panel di esperti), hanno consentito l'ascolto dei diversi target della comunicazione con riferimento alla conoscenza del Programma e al livello di gradimento delle singole attività realizzate nell'ambito della campagna di comunicazione.

5. UNA VISIONE DI INSIEME DELLA COMUNICAZIONE NELLA PAC 2014-2020

Le prescrizioni regolamentari in tema di informazione e pubblicità del FEASR sono definite dal Reg. (UE) 1305/2013 che stabilisce all'art. 66 l'obbligatorietà per gli Stati Membri di prevedere azioni informative e pubblicitarie sugli interventi cofinanziati dai PSR, definendone le modalità di applicazione nel reg. di esecuzione (UE) 808/2014 (art. 13). Nell'Allegato III[14] di tale Regolamento

[13] Con l'acronimo SMART si individuano gli indicatori che presentano cinque caratteristiche essenziali: Specificità; Misurabilità; Accessibilità; Rilevanza; Tempo-definizione.

[14] Più nel dettaglio, la parte 1, disciplina gli elementi della strategia di informazione distinguendo tra ciò che è responsabilità dell'Autorità di Gestione (punto 1) e quello che è responsabilità del beneficiario (punto 2).

Tab. 2. Quadro sinottico sulle tecniche valutative usate nei casi studio della politica di sviluppo rurale.

Valutazione	Analisi desk	Questionario	Intervista*	Focus group	Analisi SWOT	Customer satisfaction	Brainstorming valutativo
PSR e RRN Scozia	x	x	x				
PSR Finlandia	x				x	x	
PSR Galles		x	x				
PSR Sardegna	x						
PSR Veneto	x	x				x	
PSR Lazio		x	x			x	
Programma RRN	x	x	x			x	x
PSR Campania		x	x	x			

(*) comprende interviste realizzate con metodo CAPI, CATI, CAWI, in profondità a stakeholder privilegiati.
Fonte: nostre elaborazioni su rapporti di valutazioni 2007-2013.

sono poi declinati i contenuti e le caratteristiche tecniche delle strategie di informazione e pubblicità dei Programmi 2014-2020 che devono, al contempo, sia assicurare la trasparenza sui meccanismi di accesso ai finanziamenti, perseguendo una logica di pari opportunità, sia garantire visibilità alle politiche, in modo da contribuire a rafforzare presso l'opinione pubblica la percezione del ruolo svolto dall'UE e permettere al cittadino di verificare che i finanziamenti pubblici siano spesi correttamente e producano benefici per la collettività, secondo una logica di conoscenza e *accountability* (Cagliero *et al.*, 2017). La strategia delineata può poi essere estrinsecata in un documento più operativo e tecnico, il PdC, che scandisce con maggiore dettaglio, le attività da realizzarsi.

L'attuale normativa, quindi, definisce in modo chiaro e inequivocabile l'ambito di operatività e gli obiettivi della SIP e del relativo PdC, dedicando particolare attenzione anche alle modalità con cui le azioni realizzate verranno valutate in termini di visibilità e di sensibilizzazione verso il quadro strategico dei Programmi e gli interventi, nonché verso il ruolo svolto dal FEASR e UE.

A rafforzare indirettamente l'importanza dell'attività di valutazione, il Regolamento prevede un'azione di controllo e sorveglianza della strategia di informazione e pubblicità: all'art. 13, infatti, viene stabilito che l'AdG informi, almeno una volta l'anno, il Comitato di Sorveglianza, organo garante dell'efficienza e della qualità dell'esecuzione del Programma, in merito a:

- progressi nell'attuazione della strategia di informazione e pubblicità;
- analisi dei risultati;
- azioni di informazione e pubblicità da realizzare nel corso dell'anno successivo.

Se sotto il profilo dell'*accountability* e della trasparenza il disposto regolamentare appare esaustivo prevedendo la strutturazione di un flusso informativo ad hoc nell'ambito del monitoraggio e della sorveglianza, minore significatività, come tra l'altro evidenziato dalla lettura delle SIP, parrebbe essere comunque accordata alle attività di valutazione e, dunque, anche alle funzioni di conoscenza e apprendimento.

In tal senso, un migliore indirizzo proviene dal Reg. Omnibus (UE, Euratom) 2018/1046 che individua tra i temi di discussione della riunione annuale di riesame tra la Commissione e le AdG anche l'analisi delle «attività di comunicazione e informazione del programma, in particolare i risultati e l'efficacia delle misure adottate per informare il pubblico circa i risultati e il valore aggiunto del sostegno dei fondi SIE».

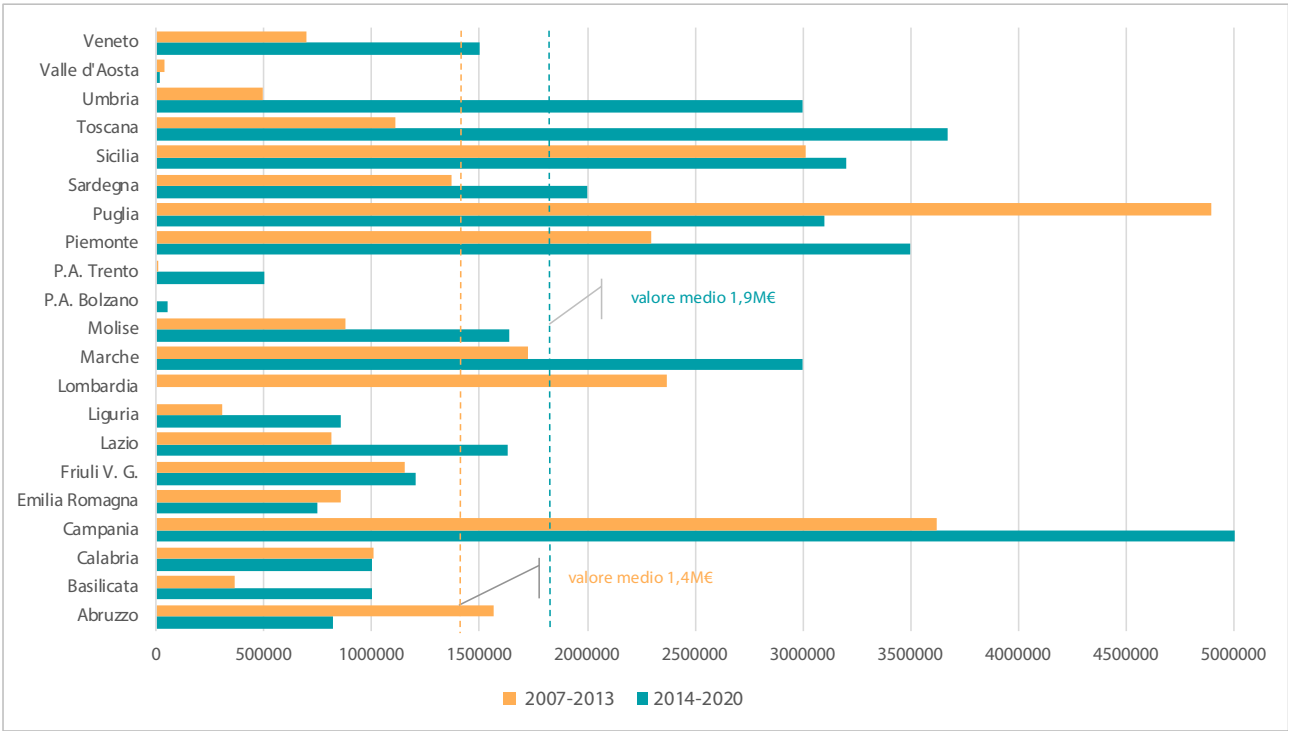
5.1. Una lettura di sintesi delle strategie di informazione e comunicazione nei PSR

Dalla lettura delle SIP regionali, si evince un approccio diversificato alla tematica, affrontata in maniera più o meno dettagliata dalle diverse Regioni e Province autonome. Nello specifico, il focus dell'analisi ha riguardato i target-group (Per chi) dei Piani, gli strumenti e i canali utilizzati per le attività di comunicazione (Come) e il sistema di monitoraggio e valutazione previsto.

Seppure tali elementi esulano dagli aspetti propriamente finanziari del Programma, non trattandosi di interventi in senso lato connessi alle priorità dello sviluppo rurale, una breve premessa sulla dotazione monetaria assegnata alle attività di comunicazione può fornire indicazioni sul peso rivestito dalla tematica nell'economia globale dei PSR (Carta *et al.*, 2017).

Complessivamente, le SIP 2014-2020 hanno intercettato, con un budget di 37,4 milioni di euro, il 10% delle risorse finanziarie destinate dalle Regioni all'assistenza tecnica. In media, verranno dedicati oltre 1,87 milioni di

Fig. 3. Raffronto dotazione finanziaria destinata alle strategie di comunicazione nei PSR 2007-13 e 2014-20 (valori assoluti in milioni di euro).



Fonte: nostre elaborazioni su strategie di comunicazione PSR 2014-2020.

euro alla comunicazione delle opportunità e dei risultati con un range di valori che va dai circa 16 mila euro della Valle d'Aosta ai 5 milioni di euro della Campania.

Lo stanziamento di risorse destinato all'attuazione della comunicazione ha, tendenzialmente subito un incremento, riflettendo da un lato, la maggiore rilevanza strategica attribuita dai regolamenti comunitari ai fini del miglioramento delle funzioni di informazione e promozione del ruolo dell'UE negli interventi a supporto dello sviluppo rurale e, dall'altro, l'aumentata complessità rispetto alla programmazione 2007-2013 (Fig. 3). Valle d'Aosta, Abruzzo ed Emilia-Romagna rappresentano una evidente eccezione a tale scelta, avendo optato per una riduzione, rispettivamente, di circa 38 mila euro, 750 mila euro e 109 mila euro a fronte di un incremento della dotazione di risorse finanziarie per l'assistenza tecnica. Anche la regione Puglia è annoverabile tra le regioni che hanno sensibilmente ridotto la dotazione a valere sulla comunicazione (-37%). Tuttavia, a differenza delle altre Regioni citate, tale decremento si inquadra in una più ampia scelta di contrazione delle risorse dedicate alla Misura 20 (Assistenza tecnica) rispetto alla corrispondente Misura 511 della precedente programmazione.

Sotto il profilo dei contenuti, particolare rilevanza assume l'illustrazione dei diversi destinatari (Per chi) delle attività di comunicazione. I target-group individuati a livello regionale sono raggruppabili in tre macrocategorie:

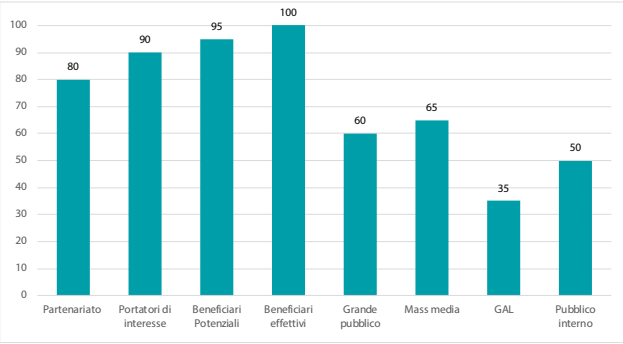
- beneficiari;
- partenariato economico-sociale e organi di informazione;
- grande pubblico (talvolta distinto in specifiche declinazioni).

In alcuni casi, tuttavia, le indicazioni contenute nelle strategie si riducono ad una mera mappatura degli interlocutori del PSR (Fig. 4). Tra questi un ruolo centrale è riconosciuto ai beneficiari degli interventi (effettivi e potenziali), i portatori di interesse (90% delle SIP) e il partenariato (80% delle SIP), mentre minore rilevanza è data al grande pubblico (60%) che, solo in limitati casi, viene dettagliato nelle sue componenti (cittadini, scuole, giovani, ecc.).

Un ulteriore elemento di indagine ha riguardato gli strumenti e i canali comunicativi previsti per la veicolazione dei messaggi ai destinatari delle politiche di sviluppo rurale.

L'efficacia della comunicazione è, infatti, strettamente connessa ad una adeguata scelta delle modalità di

Fig. 4. Principali target delle attività di comunicazione (valori in percentuale).



Fonte: nostre elaborazioni su strategie di comunicazione PSR 2014-2020.

trasferimento dei contenuti della comunicazione, considerata la varietà dei territori, dei linguaggi e dei soggetti da raggiungere. In tal senso, solo un numero ristretto di PSR[15] ha basato la propria strategia su una preliminare analisi del contesto di riferimento e poco più della metà (55%) delle regioni ha pianificato attività ed elementi comunicativi specifici per ciascun gruppo di destinatari. Nondimeno, i PdC 2014-2020 si sono contraddistinti per la definizione di un ampio ventaglio di strumenti, sia tradizionali che non convenzionali (quali, ad esempio, camper per pubblicità dinamica, giochi di ruolo e caccia al tesoro, spot al cinema).

Osservando in termini numerici la presenza delle macrocategorie sopra illustrate, tra gli strumenti web previsti, il portale, rappresentando un obbligo regolamentare, viene esplicitamente enumerato da tutti i PdC. Accanto a tale elemento cogente, è stato dato ampio spazio (80% delle regioni) ai canali social (Facebook, Instagram, Twitter), nell'intento di veicolare i messaggi dello sviluppo rurale anche attraverso applicativi di largo utilizzo e di intercettare, in tal modo, un target più giovane o, comunque, non prettamente tecnico. Altri strumenti[16] interessanti, seppure proposti in un limitato numero di PdC (35%), sono i video-tutorial e gli *instant messaging*, caratterizzati da efficacia ed immediatezza.

In considerazione del ruolo svolto dalla valutazione della comunicazione, il monitoraggio e la misurazione dell'efficacia e dell'efficienza degli interventi di comunicazione rappresentano un elemento cardine dei PdC.

Su tale aspetto, si evidenzia una diffusa presenza (75%) all'interno dei PdC di una sezione dedicata alla formulazione di indicatori, declinati per le specifiche attività di comunicazione. Nei restanti casi, non viene definito alcuno strumento di monitoraggio e valutazione o viene demandato l'onere al valutatore indipendente.

In generale, si tratta, laddove presenti, di indicatori di realizzazione (es. n. di partecipanti agli eventi; n. di pubblicazioni; n. di workshop realizzati) che solo in pochi PSR (es. Toscana e Veneto) vengono affiancati da indicatori di efficacia (es. efficacia dei singoli media rispetto alla conoscenza e consapevolezza di cittadini e beneficiari) o trovano una quantificazione dei valori attesi (es. Emilia-Romagna e Toscana).

6. ALCUNE RIFLESSIONI CONCLUSIVE

La comunicazione verso il grande pubblico nell'ambito della PAC ha assunto particolare centralità solo in anni recenti, sebbene tale politica conti ormai circa mezzo secolo di attività. A favorire tale orientamento hanno, senza dubbio, contribuito le indagini condotte attraverso l'Eurobarometro[17] (DG AGRI, 2016) che, nel 2017, hanno rilevato una conoscenza del sostegno comunitario fornito al settore primario inferiore al 50% in Italia, pari a circa il 70% in UE nel suo complesso. Il quadro fotografato dal sondaggio pone ancor di più l'accento sulla necessità di far conoscere ai cittadini, in maniera più efficace, le ragioni del sostegno pubblico e i risultati conseguiti da una importante politica comunitaria. In termini più generali, il già citato Libro bianco su una politica europea di comunicazione (Commissione delle comunità europee, 2006) poneva particolare enfasi sull'accessibilità delle informazioni (con particolare attenzione alle minoranze e ai disabili); sul rispetto della eterogeneità linguistica e culturale presente nel territorio europeo e su una maggiore vicinanza tra istituzioni e cittadini attraverso una più ampia partecipazione di questi ultimi ai processi decisionali.

A livello normativo, invece, è l'attuale periodo di programmazione 2014-2020 che conferisce piena dignità alla strategia di comunicazione della PAC verso l'esterno, enunciandola all'articolo 45 del reg. (UE) 1306/2013 (Carta *et al.*, 2017). Come evidenziato da Verrascina (2017), dall'esame del dettato regolamentare emerge, sep-

[15] Ne rappresenta un esempio il Piano di comunicazione del PSR 2014-2020 della Regione Veneto.

[16] Una importante fetta delle strategie di comunicazione è, invece, veicolata tramite strumenti tradizionali quali brochure/opuscoli (95%), pubbliredazionali (85%), pubblicazioni e comunicati stampa (80%), radio e tv (76%). Infine, tra le iniziative territoriali trovano più ampio spazio i seminari/eventi (90%), seguiti dalle conferenze stampa (70%). I PSR di Veneto, Emilia-Romagna e Toscana hanno, inoltre, previsto delle attività specifiche rivolte alle scuole.

[17] Nell'ottica di una maggiore azione di informazione, la Commissione europea ha avviato, a partire dalla metà degli anni 2000, delle indagini mirate attraverso l'Eurobarometro, un sondaggio periodico effettuato su un campione rappresentativo di cittadini europei volto ad indagare le opinioni e le percezioni in merito alle politiche comunitarie, tra cui la PAC.

pur per sommi capi, un obiettivo comunicativo piuttosto ambizioso che riguarda, da una parte, l'aumento della conoscenza della PAC e, dall'altra, la comprensione dei benefici che essa può fornire nel breve e lungo periodo, mostrandosi come modello che abbraccia aspetti economici e sociali.

Comunicare l'importanza del sostegno all'agricoltura e alle aree rurali è diventato strategico nell'ambito del II pilastro della PAC (ENRD, 2011). Anche in questo caso, Licciardo e Carta (2018) indicano che la centralità della comunicazione nella politica europea per lo sviluppo rurale emerge chiaramente dalla lettura dei regolamenti comunitari. Tuttavia, come si avuto modo di evidenziare, le SIP dei PSR 2014-2020 si limitano, salvo qualche eccezione, a riproporre i contenuti previsti a livello regolamentare in termini di obiettivi, destinatari, azioni di comunicazione, strumenti di informazione e comunicazione, pianificazione, risorse, monitoraggio e valutazione. Quest'ultimo ambito, inoltre, appare troppo spesso di carattere descrittivo e, in generale, poco approfondito. Tra l'altro, i quesiti valutativi previsti dal Regolamento di esecuzione non contemplano in maniera esplicita la tematica, ma questo non può, a parere degli autori, limitare l'importanza di indagare i processi comunicativi verso gli attori che, più o meno direttamente, sono coinvolti nell'attuazione dei PSR. Una valutazione della strategia di comunicazione e dei PdC in ambito FEASR è infatti indispensabile, non solo per avere un *feedback* sul fatto che i messaggi abbiano raggiunto il target-group e siano stati compresi, ma soprattutto perché la valutazione migliora l'efficacia della comunicazione. In tal senso, lo sviluppo di un PdC flessibile (Licciardo, Carta, 2018) e la realizzazione di valutazioni *on-time* (EC, 2015) può aiutare ad individuare quali strumenti e attività funzionano bene o, viceversa, quali potrebbero necessitare di un aggiustamento al fine del perseguimento dei risultati attesi.

A parere degli autori, sulla scorta delle previsioni regolamentari e, soprattutto, delle responsabilità che ne derivano per le AdG, si rileva, per la programmazione in corso, la necessità di rafforzare le attività di valutazione dei PdC al fine di:

- orientare la strutturazione del flusso informativo rendendolo funzionale al miglioramento continuo delle attività di comunicazione progettate, garantendo, al contempo, il controllo di efficacia/efficienza;
- individuare le (eventuali) criticità del PdC e progettare le opportune azioni correttive;
- verificare la realizzazione delle iniziative programmate;
- valutare i risultati e gli impatti conseguiti.

Ciò rafforza altresì la necessità di prevedere dei percorsi metodologici che supportino le Amministrazioni nella definizione di una adeguata domanda valutativa, accompagnata da strumenti di analisi che consentano il governo e, ove necessario, la formulazione di opportuni correttivi dell'attività di comunicazione. La complessità e al tempo stesso la rilevanza del tema, infatti, richiedono uno sforzo valutativo e una articolazione maggiore rispetto a quella attualmente definita in sede di SIP e PdC (ove presenti), al fine di pervenire, in corso di programmazione ed ex post, ad una piena conoscenza dei risultati conseguiti attraverso la strategia di comunicazione.

La lettura delle esperienze 2007-2013 ha mostrato, in estrema sintesi, che la valutazione della comunicazione pubblica, stante la sua complessità dovuta alla molteplicità di attori presenti e alle caratteristiche dell'immaterialità, della negoziabilità e della vaghezza, è necessariamente multi-metodo e fortemente orientata verso approcci valutativi di tipo partecipato. In tal senso, l'esperienza di valutazione della RRN, dove il tema della partecipazione è risultato il *leitmotiv* dell'intero processo, parrebbe essere quello più funzionale in quanto basato sul pieno coinvolgimento nel processo valutativo sia dell'AdG che degli *stakeholder* del programma favorendo, quindi, la promozione del senso di appropriazione (*ownership*) delle politiche comunitarie e dei loro risultati da parte dei soggetti in esse coinvolti.

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