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## DEFINING, ANALYZING AND IMPROVING THE GOVERNANCE OF AGROECOSYSTEM SERVICES

The present article suggests a holistic framework for defining, evaluating and improving the governance of agroecosystem services in Bulgaria. The interdisciplinary Theory of Ecosystem Services and the New Institutional Economy are adapted, and an attempt made to define the governance of agroecosystem services, to identify its agents, forms and mechanisms, to formulate an adequate criterion for evaluating its efficiency, and to characterize the stages for its analysis and improvement. The proposed new approach is based on the building up of a hierarchy of agroecosystems and services related to its different levels, as well as an assessment of the system of governance that corresponds to each level of provision of agroecosystem services.<sup>1</sup>

JEL: Q12; Q13; Q15; Q18

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The products and the variety of direct and indirect benefits that humans receive from nature and the various ecosystems (agricultural, forest, grass, desert, rural, urban, mountain, lake, river, marine, coastal, etc.) are commonly known as ecosystem services (MEA, 2005). This new and rapidly enriching category includes different types of products and services from nature and its diverse ecosystems – provisional (food for humans and animals, materials and resources for production and livelihoods, etc.), economic, a place for human life and activity, recreational, tourist, aesthetic, cultural, educational, informational, habitat, supporting, biodiversity conservation, water purification and retention, flood and fire protection, climate regulation, etc. (Executive Environment Agency, 2019; MEA, 2005).

In the last two decades, issues related to the understanding, study, evaluation and management of ecosystem services (and disservices), as well as the reduction of the damages caused by them have been among the most topical in scientific research, politics, and business and farming practices around the world (Adhikari, Boag, 2013; Allen et al., 2011; Boelee, 2013; De Groot et al., 2002; Fremier et al., 2013; EEA, 2015; FAO, 2016; Gao et al., 2018; Garbach et al., 2014; Habib et al., 2016; Lescourret et al., 2015; Laurans and Mermet, 2014; MEA, 2005; Nunes et al., 2014; Novikova et al., 2017; Marta-Pedroso et al., 2018; Petteri et al., 2013; Power, 2010; Scholes et al., 2013; Tsiafouli et al., 2017; Wang et al., 2013; Wood et al., 2015; Zhan, 2015). The increased interest in ecosystem services is a result of the fact that this emerging concept allows us to better understand the factors and goals of sustainable (agrarian) development. In addition, throughout the world, including in the EU and Bulgaria, ecosystems and their services are constantly degrading as a result of diverse human

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activity (EEA, 2015; INRA, 2017; UN, 2005). This requires public intervention (monitoring, regulation, support, evaluation, etc.) and private and collective action for their preservation, restoration and improvement (Bachev, 2009; FAO, 2016; UN, 2005).

Agricultural ecosystems of different types and their specific (agroecosystem) services are among the most widespread in the world, as well as in Bulgaria (Executive Environment Agency, 2019; EEA, 2015; FAO, 2016). By definition, agrarian ecosystems and agrarian ecosystem services are those that are related to agrarian production, which, as a rule, is a human (social) intervention in the natural order of nature. It is well known that agricultural production makes a significant contribution to the conservation, restoration and enhancement of ecosystems and their services, but also to their degradation and demolition (agricultural disservices). Therefore, services related to agricultural production and agroecosystems are among the most intensively studied, mapped, evaluated, regulated and stimulated. Various public intervention measures (regulations, support, standards, quotas, subsidies, payments, contracts, institutions, etc.) and programs (land use and landscape development schemes; water management; biodiversity conservation; reduction of greenhouse and other gases; integrated eco-management, etc.) are also implemented, in relation to their maintenance and improvement. There are also various widely spreading private, business and collective initiatives and forms for ecological intensification and for improving the management of (agro)ecosystem services of a given type, a combination of several types or as a whole.

Despite the significant progress in this new area, most studies are usually focused on a single agroecosystem service, without taking into account synergies, tradeoffs, and the needs for the integrated management of aggregate ecosystem services and disservices. An uni-disciplinary approach is broadly applied, with most of the studies being limited to purely agronomic, environmental, technological, economic, etc. aspects of management. The latter does not allow for a proper identification of the spectrum of agroecosystem services, an assessment of their integral socio-economic and ecological importance, and an understanding of the driving (institutional, economic, behavioral, ideological, political, environmental, etc.) factors of their evolution.

Studies are limited to a specific form of management (public program, government subsidy for eco-activity, quotas for resources or emissions, tax preferences, eco-contracts, eco-cooperatives, industry standards, professional codes of conduct, eco-certification, market trading) or level of management (farm, eco-system, industry, region) without taking into account the interdependence, complementarity and/or competition of different governing structures. The rich diversity and complementarity of alternative (practically used and other feasible) modes of governance (market, contractual, private, collective, public, trilateral, national, transnational) are ignored, while they increasingly govern much of the activity and behavior of agrarian and non-agrarian agents related to ecosystems. Furthermore, widely used complex forms such as multilateral, multi-level, reciprocal, interlinked, and hybrid forms are not accounted for. Only the public and formal forms and mechanisms of governance

are studied, while important informal institutions and organizations are not included in the analysis.

The management of activities related to (agro)ecosystem services is studied in isolation and not as an integral part of the overall management of the agrarian and total activities of farms, rural households, professional organizations, agrarian and related businesses, local authorities, etc. A normative approach, which is related to some ideal or model in other countries, industries, regions and is institutionally neutral (Nirvana), dominates. The specific formal and informal forms, rules, rights and restrictions, and the efficiency of their enforcement and modernization are not taken into account. Agrarian and non-agrarian agents are studied as perfectly rational and equally interested in achieving the common (eco) goals, rather than being viewed as having different interests, knowledge, skills, capabilities, positions, costs and benefits, etc. The comparative institutional analysis and assessment of the efficiency of practically possible governance alternatives in the specific socio-economic and natural conditions of a country, region, sector, community, ecosystem, etc. are not evaluated. This leads to multiple market, private and public failures in the area of eco-management.

Significant interactions between the ecosystem services and the system of governance determining the socially preferred level of costs and benefits are not specified on an appropriate temporal, spatial, institutional and hierarchical scale. The state instead of the flow of ecosystem services is evaluated, and the space-time lags and spillovers are not considered. The economic and the overall estimates are usually limited to direct (production) costs, neglecting significant indirect (third party, social) and transaction costs. As a result, the understanding and management of (agro)ecosystem services is deterred. Nor can effective scientific support be given for the improvement of public policies and programs, or for individual, business and collective action for sustainable development.

In Bulgaria, with very few exceptions (Bachev, 2009a, 2018; Bachev, et al., 2019; Kazakova, 2016; Nedkov, 2016; Nikolov, 2018; Todorova, 2017, 2017a; Bachev, 2009; Grigorova and Kazakova, 2008; Executive Environment Agency, 2019; Yordanov et al., 2017; Chipev et al., 2017), there are almost no systemic studies on the governance of agroecosystem services. The goal of the present article is to present a holistic approach for defining, analyzing and improving the governance of agroecosystem services in the country.

### **Defining and Agents of the Governance of (Agro)ecosystem Services**

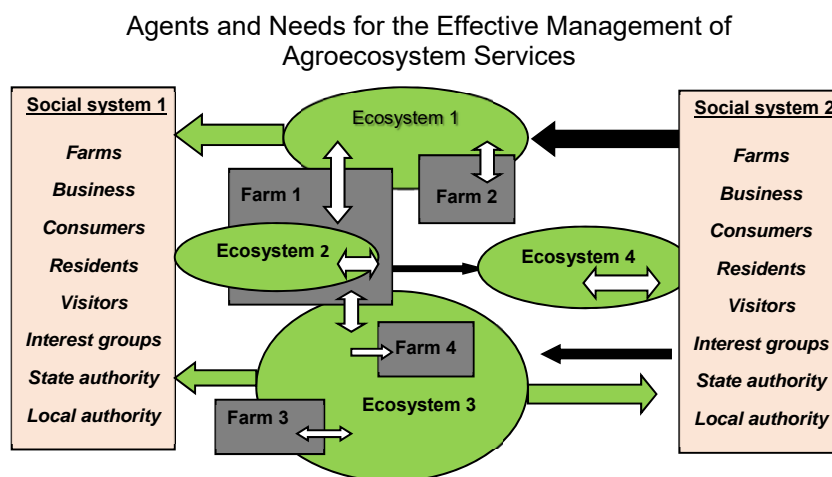
Maintaining, restoring and improving the services of (agro)ecosystems requires an effective *social governance* (a good governance) – a system of mechanisms and forms that regulate, coordinate, stimulate and control the behavior, actions and relationships of individual agents related to ecosystems and their services at various levels (Bachev, 2009, 2009a). The system of governance of agroecosystem services is a part of the specific system of management of agricultural production and it includes: different *agrarian* (farm managers, resource owners, hired labor) and *non-agrarian* (agrarian and related businesses, consumers, residents and visitors to rural areas, interest groups, administration, politicians) agents, and the various

*mechanisms* and *forms* for the governance of the behavior, activity, relationships and effects of these agents.

The governing agents of agroecosystem services and the specific type of their relationships, interests, goals, opportunities, position, dependencies, effects and conflicts are to be properly identified. At the present stage of development, the agricultural production is carried out by different types of farms – individual, family, cooperative, corporate, public, etc. *The farm* is the main organizational unit in agriculture that manages resources, technologies and activities and produces a variety of products, including the positive and negative services of agroecosystems. The governance of agroecosystem services is an integral part of the management of the agricultural farm, and the farm is *the first* (lowest) level of agroecosystem services management. Regardless of its specific socio-economic form, the system of governance of agroecosystem services will always include the farmer as a key element and it will always be aimed at improving his/her environmental conservation activities and behavior.

Farm borders rarely coincide with the boundaries of the (agro)ecosystem. A particular farm usually includes one or more agroecosystems (an agricultural parcel/section, and less frequently the entire land in the area), while at the same time it is a part of one or more different types of larger (agro)ecosystems (mountainous, plain, riparian) (see Figure 1). Therefore, a major portion of agroecosystem services is a co-production of a group of independent farms with different capabilities and interests, which surpasses the single-farm level of management and necessitates the collective actions of different farms in order to effectively supply certain ecosystem services. In addition, the individual farm often produces products (waste, pollution of water, air, etc.) that are undesirable for other ecosystems, which in turn necessitates special management, apart from that of the particular farm, for stimulating behavior that would eliminate or minimize the negative effects of the agroecosystems services.

Figure 1



Farms of different types (self-sufficient, part-time, market-oriented, member-oriented, organic, leisure) have different interests and potential for maintaining agroecosystem services. They have different purposes of existence – additional or basic income, profit, leisure, conservation of nature or farming for the future generations, etc. Farms also have unequal incentives and opportunities (resources, knowledge, time horizon of existence, positions) for sustainable agriculture. For an individual farm (the farmer is an owner) there is a complete alignment of the ecological objectives of the holding and the possibility for self-management of the produced and internally consumed and commercialized agroecosystem services. However, it has no incentive to make an effective contribution to ecosystem services consumed outside the holding, and in most cases it lacks the opportunities (sizes, resources, positions, time horizon) to realize all eco-functions on an effective scale. The latter requires outside intervention (support, compensation, regulation) by the state, or a third party, etc., and the collective action (cooperation) of many farms in order to achieve the minimum size for the efficient production of agroecosystem services of a particular kind. Bigger complex holdings (partnerships, cooperatives, corporations, state farms) and agrarian organizations with a large membership have greater opportunities (resources, knowledge, positions, etc.), but they are also faced with the internal conflicts of interests and incentives of the various agents (owners, managers, members, hired labor). The latter requires the development of a special mechanism for the coordination and stimulation of actions, reconciling interests, resolving conflicts, etc., of the numerous agents.

Other agents also directly or indirectly participate in the management of agroecosystem services, imposing appropriate conditions, standards, norms, demand, etc., or providing positive or negative services to farmers: the owners of agricultural (land, tangible, financial, intellectual) resources that are interested in their efficient use and storage; businesses related to agriculture (suppliers of inputs, finance, technology, and/or buyers of agricultural products) and final consumers. These agents impose socio-economic and environmental standards, specific support and demands for environmentally sustainable farming<sup>2</sup>. Sometimes the activities of external (non-agrarian) agents adversely affect agroecosystem services, and require special management for adequate eco-behavior. The residents, visitors of rural areas, and diverse interest groups also set conditions (pressure, demand) for environmentally friendly farming and rural areas. The state and local government, international organizations, etc., also support the sustainability initiatives of different agents and/or impose mandatory (social, economic, environmental) standards for eco-production and consumption.

In some cases, part of the agroecosystem services can be managed through the independent actions of individual farms<sup>3</sup>. Often, however, effective eco-

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<sup>2</sup> For example, processors and food chains implement own strategies and standards for sustainability, which are their own initiatives, industrial codes of behavior or the result of consumer pressure to contribute to eco-friendly production.

<sup>3</sup> For example, a good care of private farmland is typical of family farms.

management requires coordinated (collective) action by a group of farms, such as the sustainable use of common grassland and limited water supply, the protection of local biodiversity, etc. Farming is also often associated with significant (positive and/or negative) externalities which require the management of relationships (co-operation, conflict resolution, cost recovery) between different farms, and, more and more, between farmers and non-farmers. Often, agricultural contribution benefits other ecosystems (supporting and regulating ecosystem services) and a large number of residents, visitors, associated and unrelated businesses, interest groups, and future generations, without the immediate benefit to the supplying farmers – e.g. there is an inability to commercialize due to the public (non-profit) character of agroecosystem services, long time lags and spatial differences (lack of links) between investments and benefits received, etc. Then, a public intervention is required for a sustainable supply of production of agroecosystem services.<sup>4</sup>

In all these cases, the management of agroecosystem services is far broader than simple (technical, agronomic, environmental) relationships with nature and includes the governance of relationships and the collective actions of agents with diverse interests, power positions, knowledge, awareness, capabilities etc., across wide geographic, industry and time scales. Modern eco-management is increasingly associated with the need for additional actions (monitoring, coordination, investment) and the integrated management of natural resources and eco-risks nationally and, increasingly more so, transnationally. The latter includes issues related to water and waste management, biodiversity conservation, climate change, etc., which require effective regional, national, international and global governance.

Depending on the (awareness, symmetry, strength, cost of harmonization) interests of agroecosystem services agents, there is a different need to manage eco-actions and behavior in agriculture. In Figure 1, Farm 1 must manage its actions and relationships with Farm 2, as both receive services from Ecosystem 1 and affect (positively or negatively) the supply of services to that ecosystem. Both farms must also manage their relationships with users of Ecosystem Services 1 (Social System 1) to meet the aggregate demand and offset their costs of maintaining ecosystem services. Farms 1 and 2 also need to coordinate with Social System 1 to prevent conflicts with Social System 2. In addition, Farm 1 needs to manage its relationship with Farm 3 to effectively provide services to Ecosystem 3, and manage its interaction with Ecosystem 2. Farms 1 and 3 must manage their relationships with Farm 4 and Social System 1 and Social System 2. Farm 1, which has a negative impact on the services of Ecosystem 4, needs to manage its relationships with the agents in Social System 2 in order to reconcile conflicts and provide an efficient flow of ecosystem services. Therefore, Farm 1 needs to participate in seven different management systems to ensure the efficient supply of services to the ecosystems to which the farm belongs or which it affects.

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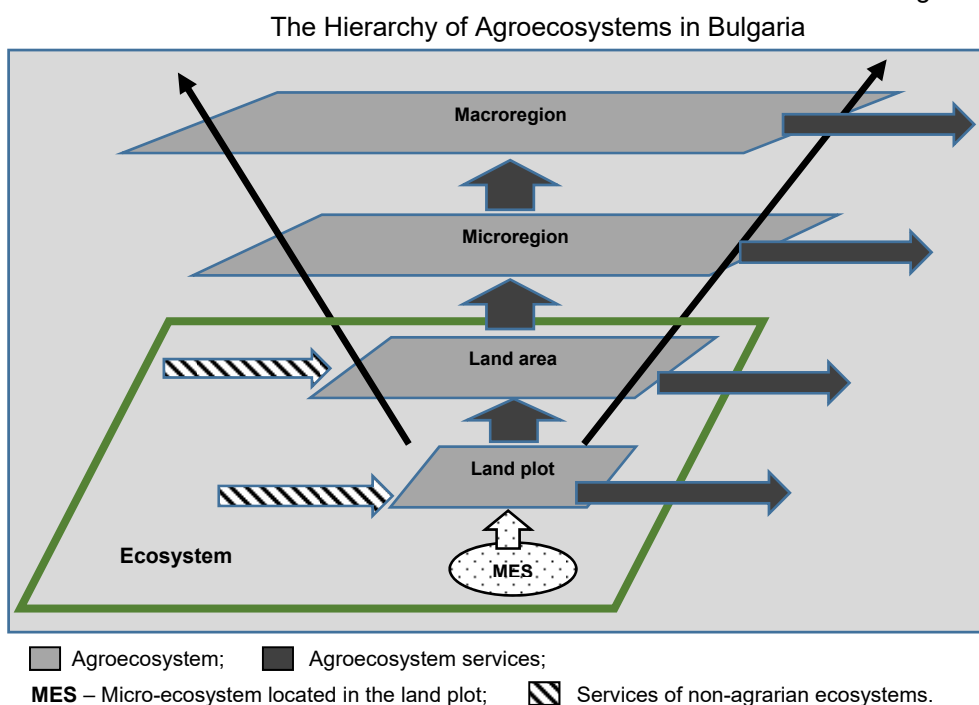
<sup>4</sup> Since it entails significant additional costs (investment, loss of income, etc.), the state compensates farmers through eco-subsidies, eco-payments, payments to disadvantaged areas, etc.

Unlike the management of pure agricultural activities (where simple private and market mechanisms work well), the effective governance of agroecosystem services activities often requires *complex, multilateral, and trilateral* forms and *multi-level* governance. For example, the farmer's involvement in the organic product chain will coordinate the relationship between producers and final consumers. However, the positive impact on the agroecosystem services will be negligible unless a form of coordination of relations (collective actions) with other farmers in an area or ecosystem is also established.

### The Hierarchy of Agroecosystems

The analysis of the system of governance of agroecosystem services requires a proper definition of the agroecosystem hierarchy and the specific services of each of its levels. The minimum relatively separate agroecosystem is the *agricultural land plot* or *section* (in the case of a closed/built-up area such as a livestock barn, a greenhouse, a beehive, a mushroom production facility, etc.) (see Figure 2). This (agro)ecosystem contains a number of non-agricultural micro-ecosystems (a lake, anthill, etc.) which contribute to the production of agroecosystem services not only for the farmland plot but also for the larger ecosystems of which they are a part, simultaneously using the services of both the ecosystem farmland plot and the larger agricultural and non-agricultural ecosystems.

Figure 2



Like any agroecosystem, the ecosystem agricultural land plot/section produces products and services that are consumed by it, by other agricultural and non-agricultural ecosystems, or by humans (production of foods and income, conservation of biodiversity and traditions, aesthetic, educational or scientific value, etc.). Often, agroecosystems at this level are a source of significant negative services, affecting themselves, other agrarian and non-agricultural ecosystems, and humans (pollution of waters, air, soils, and farm produce, soil erosion, etc.). Usually, services at the first hierarchical level of agroecosystems are an integral part of the (positive and negative) services of larger agrarian and non-agrarian ecosystems, to which they belong. Like any agroecosystem, the agricultural land plot/section consumes or is adversely affected by (pollution, competition for natural resources, etc.) the services of other or larger ecosystems, of which it is a part.

The second distinct hierarchical level of agrarian ecosystems is the so-called *land area*, which is an aggregate of numerous agricultural land plots and sections. At this level, the functions of the (agro)ecosystems, which are important for nature and society, are often realized, such as: preserving soil fertility, preserving and purifying water, preventing fires and floods, etc. The next relatively distinct level of agroecosystems is the *micro-region*<sup>5</sup> which is characterized by its own agroecosystem services. Some of the micro-region agroecosystems fall within the protected areas and territories of the Pan-European ecological network NATURA 2000, and provide an irreplaceable (joint) service – they serve as a habitat and conservation area for certain endangered wild plant or animal species.

The next hierarchical level of agroecosystems is the *macro-region*, which is characterized by its specific (agro)ecosystem services<sup>6</sup>. Some of these (borderline) agroecosystems fall into territories of two or more countries.

At higher hierarchical levels, agroecosystems are grouped into *megaregions* of different types – specific (agroecosystems in the Danube river basin, in the Black Sea basin, in Southeastern Europe), sectoral (field crops, permanent crops, grasslands, etc.), generic (plain, semi-mountainous, mountainous, riparian, coastal, urban, rural, etc.), and so on. Finally, agroecosystems can be grouped into *meta-regions* such as Europe, the Northern Hemisphere, or global. The most important contemporary eco-challenges (waste management, global warming, climatic excesses, droughts and fires, torrential rains and floods, the spread of diseases and pests, etc.) can only be mitigated by governing (agro)ecosystem services at the mega and/or meta level.

Despite many conventionalities and uncertainties, modern science has sufficiently reliable methods for categorizing (agro)ecosystems, and for accurately identifying and measuring the processes and mechanisms for the production, maintenance, degradation and destruction of (agro)ecosystem services of various

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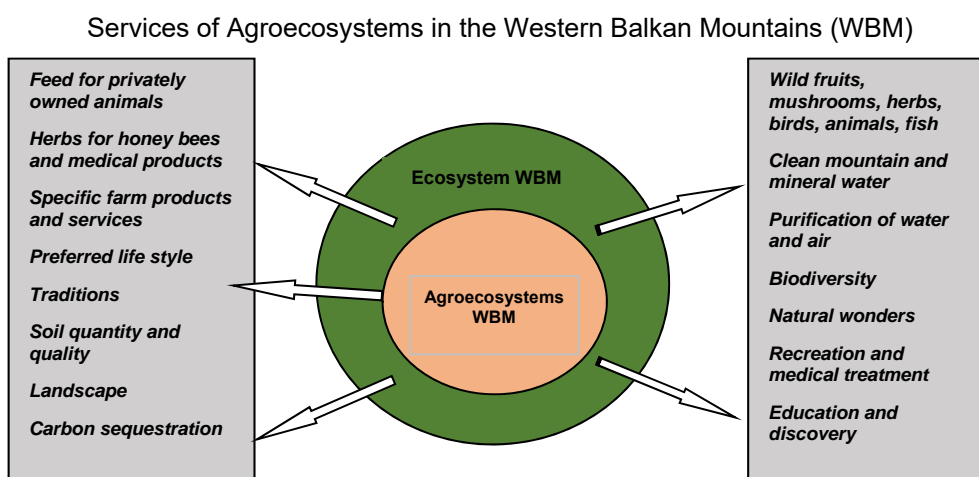
<sup>5</sup> For instance, the Sandanski-Petrich hollow, Samokov, etc., which are well-known for Melnik vine, Samokov potatoes, Melnik and Samokov cultures, traditions and landscape, recreation and tourism, etc.

<sup>6</sup> E.g. the Thracian Lowlands, the Western Balkan Mountains, the Struma river valley, etc.



kinds, and spanning across different spatial and temporal scales (FAO, 2016; Fremier et al., 2013; Gao et al., 2018; Gemmill-Herren, 2018; Kanianska, 2019; MEA, 2005; Munang et al., 2013; Petterri et al., 2013; Power, 2010; Tsiafouli et al., 2017; VanOudenhoven et al., 2020; Wood et al., 2015). In Bulgaria, the system of “Good Agricultural Practices” describes in detail the science-based methods, technologies, behavior, etc. that farmers should follow in order to keep agroecosystems and their services in good condition. The official categorization and mapping of ecosystems in the country is done by the Executive Environment Agency, which contains ecosystems of different types (including arable land and pastures) and their services (Executive Environment Agency, 2019). The comprehensive identification, categorization and evaluation of the specific services of each particular system should be the subject of a specific interdisciplinary study, in which economists must also participate. For example, Figure 3 presents the specific (agro) and combined services of agroecosystems in the Western Balkan Mountains.

Figure 3



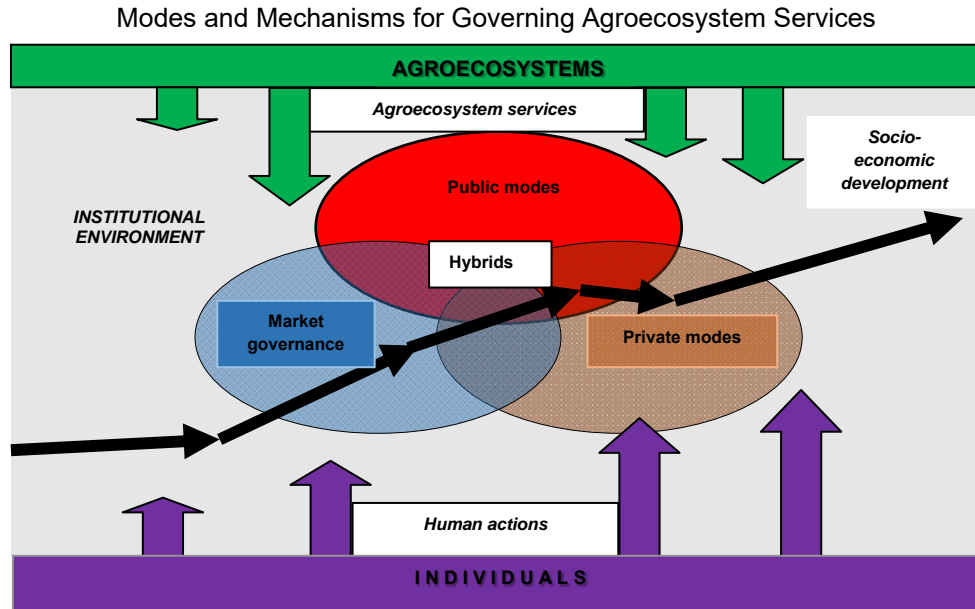
Source. Bachev, 2009a.

After specifying the type and hierarchy of agroecosystems and classifying their diverse services, the agents involved in the provision and consumption of services from each agroecosystem should be identified, as well as the mechanisms that govern the actions and relationships of related agents with each kind of ecosystem service. This is the subject of a proper in-depth (micro and macro) economic study.

### **Mechanisms and Modes of Governing Agroecosystem Services**

The system of governance of agroecosystem services includes several *principle mechanisms* and *forms* that manage the behavior and activity of individual agents and ultimately determine the level of the agroecosystem services (Figure 4).

Figure 4



First is *institutional environment* (“Rules of the game”) – that is the distribution of rights and obligations between individuals, groups and generations, and the system of enforcement of these rights and rules (Furuboth and Richter, 1998; North, 1990). The spectrum of rights may include tangible and intangible assets, natural resources, activities, clean nature, food and eco-security, internal and inter-generational justice, etc. The enforcement of these rights and rules is done by the state, social pressure, trust, reputation, private forms, or it is self-sanctioned by the agents. Some of the rights and rules are determined by formal laws, regulations, standards, court decisions, etc. There are also important *informal rules* and *rights* established by tradition, culture, religion, ideology, ethical and moral norms, etc. The institutional development is initiated by public (state, community) authorities, international actions (agreements, support, pressure), and private and collective action by individuals.

Modern development is characterized by the constant expansion of various eco-rights and obligations, including the granting of welfare rights to wild plants and animals, and to entire ecosystems<sup>7</sup>. Institutions and their modernization create unequal incentives, constraints, costs and conflicts for: protecting and improving agroecosystem services, intensifying eco-exchange and cooperation, enhancing eco-productivity, inducing private and collective eco-initiatives and investments,

<sup>7</sup> A recent trend is the provision of legal rights on entire ecosystems – initially in Pensilvania, USA 13 years ago, followed by other countries like Bolivia, Ecuador, Bangladesh, etc.

developing new eco- and related rights, reducing eco-disparities between social groups and regions, responding to environmental challenges, fair distribution of natural resources, etc.

Second are *market forms* (“the invisible hand of the market”) – a variety of decentralized initiatives driven by the movement of free market prices and market competition such as: spotlight exchange of eco-products and services, classical contract for purchase, rent or sale, production and trade with special high quality, organic, etc. products and origins, ecosystem services, etc. (Table 1). The importance of the free market for coordinating (directing, correcting) and stimulating activity, exchange and allocation of resources is well known. However, there are many examples of lack of individual incentives, choices and/or unwanted exchanges related to environmental conservation and ecosystem services – missing markets, monopoly or power relationships, positive or negative externalities, etc. The free market fails in the effective management of the overall eco-activity, exchange and investment of individuals and leads to low environmental sustainability.

Table 1

Market, Private and Collective Modes of Governing Agroecosystem Services

Market forms	Voluntary private initiatives	Special private contract	Special private organization
Spotlight sales; Classical contracts; Eco-visits, hunting, fishing, collecting wild plants and animals; Organic products; Special origins and protected origins; “Fair trade” products; Farm-gate sale; Own harvesting by the client; Farm eco-training; Eco-tourism, horseback riding, fishing; Eco-restaurants	Movements for sustainable agriculture; Voluntary “codes of eco-behavior”; Voluntary standards; “Good will”; Charity actions	Eco-contracts and cooperative agreements between farmers and interested businesses or communities involving payment for ecosystem services and resulting in production methods (improved pasture management, reduced use of agro-chemicals, conservation of wetlands), limiting water pollution, protection against floods and fires, etc.; Joint investment in eco-projects and ecosystem services	Family farms; Cooperative farms; Agro companies; Public farms; Eco-associations; Eco-cooperatives, Specialized organization for the restoration, maintenance and improvement of ecosystem services; Public-private partnerships; Protected trademarks, origins, products, etc.

Third are *private forms* (private or collective order) – various private initiatives and special contractual and organizational forms such as: long-term eco-contracts, voluntary eco-actions, voluntary or mandatory codes of eco-behavior, partnerships, eco-cooperatives and associations, trademarks, labels, etc. Conservation of natural resources is part of the management strategy of many agricultural (eco, green) farms. There are also many initiatives in the EU by farmers’ organizations, industry, retail chains and consumer organizations that are associated with raising the environmental sustainability of agricultural production. Individual agents benefit from economic, market, institutional, etc. opportunities and overcome institutional and market failures by selecting or designing new profitable private forms (rules) to manage their behavior,

relationships and exchanges. However, there are many examples of private sector failure in managing socially desirable activities such as eco-conservation, ecosystem services, conservation of traditional species, production, rural areas, etc.

Fourth, *public forms* (public policy) – various public (community, state, international) interventions in the market and private sectors such as: public recommendations, regulations, support, taxation, financing, provision, modernization of rights and rules, etc. (Table 2).

Table 2

Forms of Public Intervention in Agroecosystem Services

New property rights and enforcement	Public regulations	Public taxation	Public support	Public provision
Rights for a clean and beautiful environment and biodiversity; Private rights over natural, biological and environmental resources; Collective rights over irrigation waters, pastures, etc.; Private rights for the profit-oriented management of natural resources; Tradable pollution quotas (permits); Private rights to intellectual products, origins, (protection) of ecosystem services; Rights for issuing eco-bonds, shares in ownership; Private liability for pollution; Provision of legal person rights to parts of or entire ecosystems	Regulations for organic farming; Regulations for trading in ecosystem services protection; Emissions and use quotas for products and resources; Regulations for the introduction of alien species, genetically modified crops; Prohibition of certain activities, use of resources and technology; Nutrition and pest management standards; Regulations for protecting water from nitrate pollution; Regulations for biodiversity and landscape management; Licensing for the use of water and agro-ecosystems; Rules and quotas for the use of sewage sludge; Quality and safety standards; Standards for good agricultural practices; Compulsory eco-education; Certification and licensing; Mandatory eco-labeling; Identification of threatened areas and reserves; Set-aside measures; Inspections, fines, termination of activity	Tax preferences; Eco-taxes on emissions and products; Fees on overproduction of manure; Fees on manufacturing or export for financing innovation; Waste tax; Farmland tax	Recommendations, information, demonstrations; Direct payments; Subsidies for eco-actions of farms, businesses and communities; Preferential Credit; Public eco-contracts; Government procurement (water and other resources); Price and production aid for organic production and special origins; Financing of eco-education; Assistance for farmers and environmental associations; Collection of fees to pay for the provision of ecosystem services;	Scientific research; Market information; Agro-meteorological forecasts; Sanitary and veterinary control, vaccinations, preventive measures; Public Agency (Company) for important ecosystems; Hail Suppression Agency; Applying the "precautionary principle"; Environmental monitoring; Eco-forecasts; Risk Assessment

Agrarian and rural development programs are implemented, which are aimed at the proportional development of agriculture and regions, preserving and improving the natural environment, etc. In many cases, the effective management of individual activity and/or the organization of certain activities through market mechanisms or through private contracting may take a long time, be very expensive, fail to reach the socially desirable scale size, or not take place at all. Centralized public intervention could reach the desired state faster, with less cost or more efficiently. The public is involved in the management of agroecosystem services by: providing eco-information and eco-training to private agents, stimulating and (co)financing their voluntary

activities, imposing mandatory eco-regulations and sanctions, organizing eco and related activities (state-owned eco-enterprise, research, monitoring), etc. However, there are many cases of poor public involvement (inaction, under-intervention, over-regulation) that lead to significant development problems.

Fifth are *hybrid forms* – some combination of the above three, such as public-private partnerships, public licensing and inspection of private bio-farms, etc. For example, the supply of many of the ecosystem services by farmers can hardly be managed through private contracts with individual consumers due to the low appropriability, high uncertainty and rare character of the transactions (high costs for negotiation, contracting, payment from potential customers, disputing) (Bachev, 2012). Supplying eco-services is very expensive (additional production and organizational costs) and is unlikely to be done on a voluntary basis. The financial compensation of farmers by willing consumers through a pure market form (fee, premium) is also inefficient due to the high information asymmetry and the enormous enforcement costs. A *trilateral form* with direct public involvement makes these transactions effective: on behalf of current and future consumers, a state agency negotiates a contract with farmers for an environmental conservation service, coordinates the activities of the various agents, provides public payment to farmers for the eco-service and controls the fulfillment of the contractual conditions.

The efficiency of the individual forms of governance of agroecosystem services of different types is quite different since they have unequal potential to: provide adequate eco-information; induce positive eco-behavior; resolve eco-conflicts and coordinate eco-activities of different participants; improve environmental sustainability and reduce eco-risks; minimize overall eco-management costs (for conservation, third party, transaction, etc.), for agents with different preferences and opportunities, and under the specific (socio-economic, natural) conditions of each eco-system, community, industry, region, and country. For example, proper eco-information and training is sufficient to induce voluntary action by a “green” farmer, while most commercial enterprises need external incentives (market premium, monetary compensation, penalties); market prices generally coordinate well the relations between the suppliers and users of waters, while regulating relationships between water pollutants and users requires a special private or public form; farmers’ independent actions improve the condition of local eco-systems, while solving most of the (regional, national, global) eco-problems requires collective action on a large scale and over large time periods, etc. In the long run, the specific system of governance of the agricultural sector and sustainability (pre)determines the type and character of socio-economic development (Figure 4). Depending on the efficiency of the established system of governance of agroecosystem services, individual farms, sub-sectors, regions and countries achieve different results in the conservation, restoration and improvement of ecosystems, and there is a different state of natural resources, level of eco-risks and eco-costs related to the development of the agricultural sector, and unequal environmental sustainability of individual farms, sub-sectors, regions, agriculture, and different countries.

### Factors for the Choice and Efficiency of the Governance Mode

In rare cases, there is only one practically possible form of managing the activity and relationships associated with a particular agroecosystem service.<sup>8</sup> Often, many *alternative* (market, private, public, hybrid) forms of governance are possible – e.g. the provision of a biodiversity conservation service can be managed: as a farmer's voluntary activity; through a private contract of the farmer with an interested/affected agent; through an interlinked contract between the farmer and the supplier/processor; through cooperation (collective action) with other farmers and stakeholders; by trading on the (free) market or through trade with special (organic, protected, fair-trade) products with the support of a third party (certification body); through a public contract specifying the farmer's obligations and compensations; through a public decree (regulation, resource/emission quotas, taxation); through a hierarchical public agency (company), or through a hybrid form.

There is no single universal form for governing all types of agroecosystem services which is equally effective for all agents in diverse socio-economic and natural conditions (Bachev, 2014). *The choice* of managerial mode for a particular service and the development of the system of agroecosystem services management depends on various factors. For example, the choice of governing form strongly depends on the *personal characteristics* of the *farmers* and *other participants* in the process – personal preferences, (ethical, religious) views, experience, awareness, training, willingness for association and/or risk-taking, professional and financial capabilities, reputation, trust, tendency for opportunism, power positions, age, eco-innovation, entrepreneurship, leadership, etc. Usually, younger, more educated and innovative farmers are more actively involved in various new forms of management of agroecosystems. The specific benefits for the individual farmer from eco-management take different forms – monetary or non-monetary income, profit, indirect economic benefits, enjoyment of eco-activity, desire to preserve nature for future generations, etc.

Another important factor is the *development of science and technology*, which: determine the extent of awareness of the types, factors and importance of the ecosystem services; provide more complete information on environmental problems and risks, and the positive and negative impact of agricultural practices; provide new opportunities for the effective management of activities related to the preservation and improvement of the services of agroecosystems of different kinds (precision agriculture, digitalization, automation of monitoring, operations, etc.), and so on. Digitization, for example, is revolutionizing the forms of gathering and processing information, sharing know-how, finding trading and coalition partners, cheap online marketing of eco-products nationally and transnationally, etc. The development of science and technology is also related to some new challenges for the system of

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<sup>8</sup> For example, in Japanese agriculture with scattered rice paddies, individual farmers would not be capable of ensuring the water supply (high interdependence, indivisibility of use), and therefore, from the earliest times until now, the organization of water retention and use has evolved as a public project.

eco-management and control associated with the use of GMOs, artificial intelligence, etc.

The choice of governance form also depends on *the state* of ecosystems, the character of the *environmental problems and risks*, and the socio-economic and ecological *significance* of the service. As a rule, a high social value and a greater environmental risk more easily induce private coalition and more public forms of intervention (standards, subsidies, regulations, etc.). For example, the big problems associated with the storage of manure and sewage sludge in the country led to the emergence of a new form – providing free delivery to client farms by the livestock complexes and water supply companies.

The choice of management form also strongly depends on *market* and *public demand* (and pressure) for the sustainable exploitation of natural resources. The nature of this demand depends on the overall socio-economic development, social importance, and priority (socio-economic and environmental) challenges at the relevant stage. Wealthy consumers and societies are willing to pay more for a wide range of ecosystem services – a premium for eco-products and services, generous state and local programs for the conservation of nature, cultural and historical heritage, lifestyle, etc.

The choice of governance form depends very much on the *character of the service* of the agroecosystem, the *relationship between cost and benefits*, and the amount of *time and space lag* between investment and effect. For ecosystem services with immediate benefits to the farmer and/or consumer, the market and private management works well, while for those requiring long-term and large-scale investments for the production of services with a public goods character, more long-term and complex forms are necessary.

The evolution of the system of eco-management depends on the prevailing *institutionally determined eco-rights, norms and obligations*, and on the *existing and practically possible market, private and public forms* of governance. The management form is often (pre)determined by the institutional constraints, in that some forms of farming, environmental, etc. activities are socially unacceptable or illegal. For example, free market and private activity in protected areas is not allowed, private ownership and trade in certain natural resources (water, genetic diversity) is not possible, etc.

Another important determinant of the system of governance are *public (national, European) policies*<sup>9</sup>, as well as the implementation of *international conventions and agreements* on various aspects of environmental sustainability. They create a new (national, European, global) order by introducing new rights and rules, markets and directions for development.

The system of eco-management also depends on the natural *evolution of the natural environment* (global warming, extreme climate, drought, etc.), which imposes

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<sup>9</sup> Some “green” governments give high priority to environmental protection, while others prioritize economic growth at the expense of the degradation and even destruction of natural resources.

new private, collective and hybrid forms that help the confrontation of negative trends and/or the effective adaptation to natural (and social) changes.

A *pure economic* factor that determines the choice of governing form is related to the efficiency. Individual governing modes are alternative, but not equally effective forms for organizing activities and transactions associated with a particular agroecosystem service. Each of them has specific *advantages* and *disadvantages* for safeguarding eco-rights and investments, for the coordination and stimulation of socially desirable eco-behavior and activities, for the exploration of economies of scale and scope, and for the minimizing of production and transaction costs<sup>10</sup>.

In the specific natural and institutional environment, various agents can manage their relations through the *free market* (adapting to market prices), through *negotiation* (agreeing on a private order), through *coalition* (collective decision making), in an *internal organization* (“the hand of the manager”), or through a *public form* or *hybrid organization*. Rational agents tend to choose or design *the most effective* forms for governing of their relations that maximize their benefits and minimize their costs. In the long run, management forms that minimize *transaction* costs ultimately dominate (Williamson, 1985).

In the unrealistic conditions of zero transaction costs and well-defined private property rights, the state of maximum efficiency is always achieved regardless of the initial allocation of rights between individuals and the form of governance (Coase, 1960). All information about the efficient exploitation of natural and technological opportunities and the satisfaction of demand would be *costlessly* available for everybody. Individuals would costlessly coordinate their activities and protect their (absolute and contractual) rights<sup>11</sup>, and they would trade own resources (exchange the rights on them) in the mutual interest with *equal* efficiency in the free market, through private organizations of different types, through collective decision-making, or in a single national hierarchy (company). Then the optimal requirements for environmental sustainability, and the maximum potential for economies of scale and scope (maximum environmental protection/improvement, and productivity of resource, internalizing externalities), and the improvement of their well-being (consumption, provision of ecosystem services, etc.), would be easily and costlessly achieved.<sup>12</sup>

However, when transaction costs are significant, the costless negotiation, exchange and protection of individual rights is impossible. Therefore, the initial distribution of property rights between individuals and groups, and their good definition and enforcement, are critical for the overall efficiency and sustainability. For example, if the right to a clean environment is not well-defined, that creates

<sup>10</sup> A detailed description of the advantages and disadvantages of the various forms of governance is made in Bachev (2012; 2014).

<sup>11</sup> In a world of zero transaction costs, the definition (redistribution) of the *rights* by individuals, groups, and society, as well as the effective enforcement of the new rights would be easily (costlessly) achievable.

<sup>12</sup> At the present stage, there is a *principled agreement* (a social contract) for global sustainable development.



great difficulties for the effective supply of ecosystem services – costly disputes between the pollutant and the affected agents; disregard for the interests of particular groups or generations, etc. Moreover, even when rights are well-defined, the eco-management is usually associated with significant transaction costs. For instance, the agents have to deal with the cost of identifying different rights and effectively protecting them (unwanted appropriation by other agents); of studying and complying with the various institutional restrictions (rules, standards, rules); of collecting the necessary technological, eco- and other information; of finding the best partners and prices; of negotiating the terms of the exchange; of the writing and registration of contracts; of enforcing exchange terms through monitoring, control, measurement and safeguards; of disputing rights and agreements in court or otherwise; of the adaptation or termination of agreements along with the evolution of conditions of production and exchange, etc.

Therefore, in the real world with incompletely defined and/or enforced rights and positive transaction costs, *the form* of agroenvironmental governance becomes critical and (pre)determines the extent of degradation, conservation and enhancement of (agro)ecosystems and their services (Bachev, 2012, 2014). This is because different governance structures have *unequal efficiency* (effect, costs) in organizing the same activities related to the production and consumption of ecosystem services in the specific socio-economic and natural environment. Often, the high transaction costs make it very difficult and even block the organization of otherwise efficient (mutually beneficial) activities and exchanges for all participants<sup>13</sup>.

Transactional costs are to be well distinguished from the production (agronomic, opportunity<sup>14</sup>, etc.) costs for environmental protection. In the contemporary environment, the latter are an important economic cost that is to be recovered similarly to other technological costs from the beneficiaries of the preserved/improved nature. Often, that is the farmer who invests in order to maintain the productivity of the natural resources (land fertility, water cleanliness, ecosystem services), and reimburses these costs like other investments through a stream of future benefits (productivity, profitability, market positions, etc.). Increasingly, however, these are other agents who pay for the used eco-services either directly (through the purchase of eco-products and services) or indirectly (through collective organizations, taxes and fees, etc.).

The effective forms for governing of ecosystem services optimize *the overall* (transaction *and* production costs of) agricultural activity – minimizing transaction costs and allowing (otherwise mutually beneficial) eco-exchange to be realized on a socially desirable scale; allowing the achievement of the minimum/optimal environmental

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<sup>13</sup> Most often, the supplier and the user of agroecosystem services are different agents, which implies a transaction (desired or unwanted exchange) between them.

<sup>14</sup> The missed income from the traditional or other feasible activities may be used as opportunity costs<sup>14</sup> for the current eco-costs, while the long-term investments for the restoration of natural resources or for their replacement with another natural, material etc. resource may be used for the current eco-investments.

requirements and/or the exploration of purely technological economies of size and scale in farming, eco- and other activities.

The production costs for the provision of agro-eco-services are relatively easy to measure. However, much of the associated transaction costs are difficult or impossible to measure. Therefore, the (most) effective form of governance is determined through *Discrete Structural Analysis*, according to the (combination of) the *critical dimensions*<sup>15</sup> of the activity and the transactions (Bachev, 2012; Williamson, 1985). In a previous publication, we have identified the most effective market, contractual and internal forms of eco-management, depending on the critical factors of transactions and activity (Bachev, 2014).

The rational agents tend to use and/or design such forms for governing their diverse activities and relationships that are *the most effective* for the specific institutional, economic and natural environment – modes that maximize their *overall* (production, environmental, financial, transactional, etc.) *benefits* and minimize their *overall* (production, eco-maintaining, transaction, etc.) *costs* (Bachev, 2012; 2014). However, the result of this *private (and market)* optimization of the management and the activity is not always the most efficient allocation of resources on a social scale nor is it a socially desirable (maximum possible) environmental conservation activity. Agricultural activity is often accompanied by significant undesirable negative eco-effects – soil degradation, water pollution, biodiversity destruction, air pollution, significant greenhouse gas emissions, etc., including in Bulgaria (Executive Environment Agency, 2019). The market and the private sector *fail* at the effective governance of a significant proportion of transactions associated with agroecosystem services with low appropriability, high and unilateral specificity of investment, high uncertainty, and low repetition/frequency. There is a need for a *public intervention (government, international aid) as a third party* to make such eco-activities and transactions possible or more efficient. However, public intervention in (eco-)governance is not always more effective, since *public failure* is actually possible. In the country and around the world, there are many examples for inappropriate, excessive, insufficient, untimely or too expensive public intervention at all levels. Often, public intervention either fails to correct market and private sector failures or it corrects them at the expense of larger overall costs.

*The criterion* for assessing the efficiency of the agroenvironmental governance should be whether the *socially desirable and practically feasible eco-goals (e.g. the volume of agro-ecosystem services) are achieved at the lowest possible total cost* (direct, indirect, private, public, production, environmental, transactional etc.). Accordingly, inefficiency is manifested in the *failure to achieve the really possible* (technical, political, economic) *ecological objectives* (overcoming certain eco-problems, minimizing existing eco-risks, reducing eco-losses, restoring and improving the natural

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<sup>15</sup> Frequency, uncertainty, asset specificity (Williamson, 1985), and appropriation (Bachev, 2012) – the factors that cause variation in transaction costs between alternative forms of management.

environment, increasing agro-ecosystem services, etc.) or in the achievement of the set goals at an *excessive cost compared to another feasible form of governance*.

### **Stages in the Analysis and Improvement of the Governance of Agroecosystem Services**

The *analysis* and *improvement* of the system of governance of agroecosystem services should include the following steps: *First*, the trends, factors and risks associated with (agro)ecosystems and the supply of agroecosystem services must be identified. Modern science provides sufficiently precise methods for assessing the state of ecosystems of different kinds, and for identifying existing, evolving and likely problems such as climate change, the degradation and destruction of natural resources and ecosystems, eco-risks, etc. (MEA, 2005). Moreover, it offers reliable tools for assessing the (positive and negative) impact of agriculture on the (health) state of nature, its main components, and ecosystem services of various types, including at different spatial and temporal scales. For example, systems of multiple eco-indicators for pressure, state, response, and impact, volume and structure of ecosystem services, integrated assessment of agroecosystem services, eco-sustainability of agriculture, etc., are widely applied. The absence of *serious eco-problems, conflicts and risks* is an indicator that an *effective system for the governance of agroecosystem services exists*. In most cases, however, significant or increasing eco-problems and risks related to agricultural development are observed, as is the case with Bulgaria (Executive Environment Agency, 2019).

*Second*, the efficiency of *existing* and *other possible* forms and mechanisms of governance for overcoming existing, evolving and possible eco-problems and risks associated with the services of agroecosystems of every type are to be evaluated. The analysis is to cover the agro-eco-management system and its individual elements – *institutional environment* and *diverse* (formal, informal, market, private, contract, internal, external, individual, collective, public, simple, complex, etc.) *forms* for governing the activities and relationships of related agents.

It is necessary to analyze the *de facto* rights over tangible and intangible assets (material and intellectual agrarian and eco-products and services), natural resources, certain activities, clean nature, food and eco-security, internal and inter-generational justice, etc., which are relevant to the services of agro systems. The efficiency of the system for the enforcement of rights and rules by the state, public pressure, trust, reputation, private and collective forms, or by the agents themselves also have to be analyzed. The extent to which the institutional environment creates incentives, constraints and costs for individual agents and society to preserve, restore and improve agroecosystems and their services, to intensify the eco-exchange and cooperation of related agents, to increase the productivity of resource use, to induce private and collective eco-initiatives and investments, to develop new eco-rights, to reduce disparities between different (agro)ecosystems, to overcome the socio-economic and environmental problems, conflicts and risks, etc., are all to be assessed.

The assessment of the efficiency of individual market, private, collective, public and hybrid forms of governance is to incorporate their *absolute* and *comparative potential* in order to protect and develop the eco-rights and investments of the agents, to promote the socially desirable level of environmental behavior and activity (agroecosystems services), to rapidly identify the eco-problems and risks, to cooperate and resolve eco-conflicts, and to minimize and recover the total eco-costs (for conservation, restoration, improvement, transaction, direct, indirect, private, public, etc.). The *complementarity* and/or *contradiction* of different modes of governance are to also be assessed – for example, the high complementarity between (some) private, market and public eco-governance forms; the contradiction between the “gray” and “light” sectors; conflicts between the agrarian and non-agrarian sectors regarding natural resources and ecosystem services, etc.

Most of the applied forms of agro-management of *activity* are integral and they affect more than one aspect of agriculture and agroecosystem services. In addition, the improvement of one type of agroecosystem service (e.g. food production) through a particular form of management is often associated with negative effects on another type (e.g. the conservation of natural biodiversity). Therefore, the *overall efficiency* of a given form, of a particular package of instruments or of the system of governance as a whole must always be taken into account.

The analysis and evaluation of the system of governance of agroecosystem services is a complex, multidimensional and interdisciplinary process that requires in-depth knowledge of the advantages and disadvantages of specific forms of governance and a detailed characterization of their efficiency (benefits, costs, effects) in the specific conditions of each agricultural agent, agricultural farm, type of farm, ecosystem, sub-sector, region, etc. Quantitative indicators are of little use here and most often a *qualitative* analysis of the comparative advantages, disadvantages and net benefits is needed. Even when the system of agroecomangement and agroecosystem services management *works well*, periodic *performance (efficiency) checks* have to be made. This is so because good environmental protection may have been achieved with *excessive* public expenditures, or a *further improvement* of agroecosystem services at the *same* social costs may be missed. In both cases there is an alternative *more effective* organization of the management of agroecosystem services. For example, public eco-governance, which may be costly for the taxpayer (in terms of incentives, overall costs, adaptation and investment potential), can be replaced by a more effective private, market or hybrid form (public-private partnership).

*Third*, the *inefficiency* (failure) of dominating market, private and public forms is to be detected, and the *need for new public intervention* in the management of agroecosystem services of every kind is to be identified. They may be related to the inability to achieve the socially desirable and practically possible eco-goals, the significant transactional difficulties (costs) for participating agents, the inefficient use of public funds, etc.

Finally, the *alternative forms of new public intervention* that can overcome existing (market, private and public) failure are to be identified; their *comparative efficiency and complementarity* is to be *evaluated*, and the *most effective one(s) are to be selected*. It is important to compare only *practically* (technically, economically and politically) *possible* forms of new public intervention in the management of agroecosystem services of every kind in the specific socio-economic, organizational and natural environment.

The public forms not only support (market *and* private) transactions, but they are also associated with significant (public and private) costs. Estimates have to include *all* costs of implementation and transaction – the direct costs (of taxpayers, supporting institution), the transaction costs (of coordination, stimulation, control of opportunism and mismanagement) of bureaucracy, the costs of individuals' participation in the public forms (for adaptation, information, paperwork, fees), the costs of social control over and the reorganization (modernization, liquidation) of public forms, *and* the (opportunity) costs of public inaction<sup>16</sup>.

The proposed analysis is to be made *at different levels of agroecosystems* (farm, area, micro-region, macro-region, national, international), depending on the *type of eco-challenge* and the scale of the *collective action needed* to eliminate the specific problems and risks associated with the agroecosystems and their services. The identification and evaluation of the dominating specific forms of governance of the agroecosystem services of a given type in a particular country, macro and micro-region, etc., is to be the subject of a special micro multidisciplinary study. They require a multidisciplinary approach and the use of diverse information for the eco-state, risks, public programs and measures, scientific, statistical and forecast data for the development of ecosystems, etc., as well as the collection of new micro and macro information on the forms, costs, factors, effects and intentions of the agents involved in the management of the services of agroecosystems at the relevant hierarchical levels.

The analysis and improvement of the governance of agroecosystem services is not a one-off act that ends with a perfect system for the governance of agroecosystem services at the final stage. Rather, it is a permanent *process* that should improve the eco-governance along with the evolution of the natural environment, the individual and collective (social) knowledge and preferences, and the modernization of the technology and the institutional environment. Moreover, the *public* (local, national, international) *failure* is possible (and often prevails), leading us again to the next cycle of improving the eco-governance in agriculture. In some cases, it is not at all impossible to affect the natural environment through (agro)management and *effective adaptation* is the only possible strategy for overcoming the environmental consequences for agricultural and other sectors of human activity.

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<sup>16</sup> The value of some *eco-losses* can be expressed in economic terms (reduction of income in related industries, replacement and recovery costs, negative impact on human well-being, etc.), while a significant part of the social costs cannot be expressed in monetary terms (the negative impact on biodiversity, other ecosystems, human health and life, future generations, etc.).

The proposed comparative institutional analysis also allows us to *anticipate* the probable cases of *new* public (local, national, international) failure as a result of the inability to mobilize sufficient political support and the necessary resources and/or ineffective implementation of otherwise good policies in the socio-economic conditions of a particular country, macro or micro agroecosystem. Because public failure is a *practically feasible option*, its timely detection makes it possible to anticipate the existence or deepening of certain environmental problems and to inform the (local, international) community about the risks involved.

### Conclusions

The study of the forms, factors and efficiency of the governance of agroecosystem services in Bulgaria is at an early stage. In this new area, many traditional economic approaches and models are not working well, and a multidisciplinary and interdisciplinary analysis is needed, to which economists have to contribute. Empirical research is also to be initiated to test and improve the theory, and to effectively support policies and farming strategies and practices. This requires the collection of new types of micro and macro information on the personal characteristics of the participants in the production and consumption of agroecosystem services, for the type and forms of their relationships, for the specific socio-economic and institutional environment, and for the agroecosystems of different types, and their diverse services at different levels and horizons of management.

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