Governing of agro-ecosystem services - modes, efficiency, perspectives

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Introduction

The issues of assessment and management of ecosystem services have been taking increasing attention in recent years (Berge and Stenseth; Boyd and Banzhaf; Daily, 1997, 2000; Duraiappah; Farber *et al.*; Hanson *et al*.; MEA). A number of studies on specific challenges, institutions, and policies for agro-ecosystem services have also appeared (Antle; Gatzweiler *et al.*; Jolejole *et al.*; Shiferaw *et al.;* OECD, 2001; VanLoon *et al.*; WISP). It is recognized that maintaining and improving ecosystem services requires an effective social order (governance) and coordinated actions at various levels (individual, organizational, community, regional, national, transnational). It is also known that effective forms of governance are rarely universal and there is a big variation among different ecosystems, regions, countries. Efficiency of environmental management depends on specific governing structures which affect in dissimilar ways individuals behavior, give unlike benefits, command different costs, and lead to diverse performances (Bachev, 2007).

Research on mechanisms of governance of agro-ecosystem services is at beginning stage due to "newness" of problem, little awareness, emerging novel challenges, "lack" of long-term experiences, and fundamental institutional modernization during the last two decades. Most studies focus on certain hotspots or type ecosystems (e.g. pastoral, crop) and individual modes (formal, contract, business, public). What is more, "normative" (to some ideal or external to a country) rather than comparative institutional approach between feasible alternatives is employed. Likewise, significant social costs associated with the governance (known as transaction costs) are not or only partially taken into consideration. Furthermore, uni-disciplinary approach dominates, and efforts of economists, lawyers, sociologist, ecologists, behavioral and political scientists are rarely united. Besides, there are little studies on specific natural, economic, institutional, international etc. factors responsible for the variation among different ecosystems, regions and countries.

Consequently, our understanding on factors of governance of ecosystem services is impeded, spectrum of feasible (informal, market, private, public, integral, multilateral, transnational) modes cannot be identified, and their efficiency, complementarities, and prospects of development assessed. All these restrict our capability to assist public policies, and individual, business and collective actions for effective supply of ecosystem services.

In this book we incorporate interdisciplinary New Institutional and Transaction Costs Economics (combining Economics, Organization, Law, Sociology, Behavioral and Political Sciences), and suggest a new framework for analysis of mechanisms of governance of agro-ecosystem services.

The *first part* of the book discusses the modern concepts and the economics of agro-ecosystem services. After that, it presents a framework for analysis and improvement of the governance of agro-ecosystem services. This new approach takes into account: the role of the specific institutional environment; and the behavioral characteristics of individual agents; and the transaction costs associated with the various forms of governance; and the critical factors of agrarian activity and exchanges; and the comparative efficiency of market, private, public and hybrid modes; and the comparative efficiency of alternative modes for public intervention; and the complementarities between different modes and the needs for

multilateral and multilevel governance; and the role of technological and ecological factors.

The *second part* of the book identifies and evaluates the efficiency of market, private and public modes of environmental governance in Bulgarian agriculture. It depth analyses is made on structures for governing agro-ecosystems services in Zapadna Stara Planina, a mountainous region in the North-West part of the country. Assessment on prospects for evolution of environmental governance in the conditions of EU CAP implementation follows.

This book aims to give insights on modern understanding of environmental governance, and elaborate a holistic framework for analysis and improvement of the governance of agro-ecosystem services, and test this new approach in the transitional Bulgarian conditions. In addition, diverse (positive and negative) examples from different countries are widely used to support arguments of the author.

I am enormously thankful to VDM Publishing House giving me that extraordinary opportunity to present my work on agro-ecosystem services governance to the large world audience.

Part 1. Mechanisms of Governance of Agro-Ecosystem Services

1. Agro-ecosystem services and the governance

Ecosystem services are the multiple resources, products, processes and other benefits which humans obtain from the natural ecosystems (Daily, 1997; MEA). For instance, about 220000 out of the estimated 240000 species of plants for which pollination is important make use of the free "services" of over 100000 different animals (bats, bees, beetles, birds, butterflies, flies), and this includes wild plants and around 70 percent of the agricultural crop species that feed the world (Daily, 1997). In the United States alone, the agricultural value of wild, native pollinators (sustained by natural habitats adjacent to farmlands) is estimated in the billions of dollars per year. Likewise, approximately 80% of the human population relies on traditional medical systems, and about 85% of traditional medicine involves the use of plant extracts (Farnsworth *et al.*). What is more, among top 150 prescription drugs used in the United States, 118 are based on natural sources - 74% on plants, 18% on fungi, 5% on bacteria, and 3% on one vertebrate species.

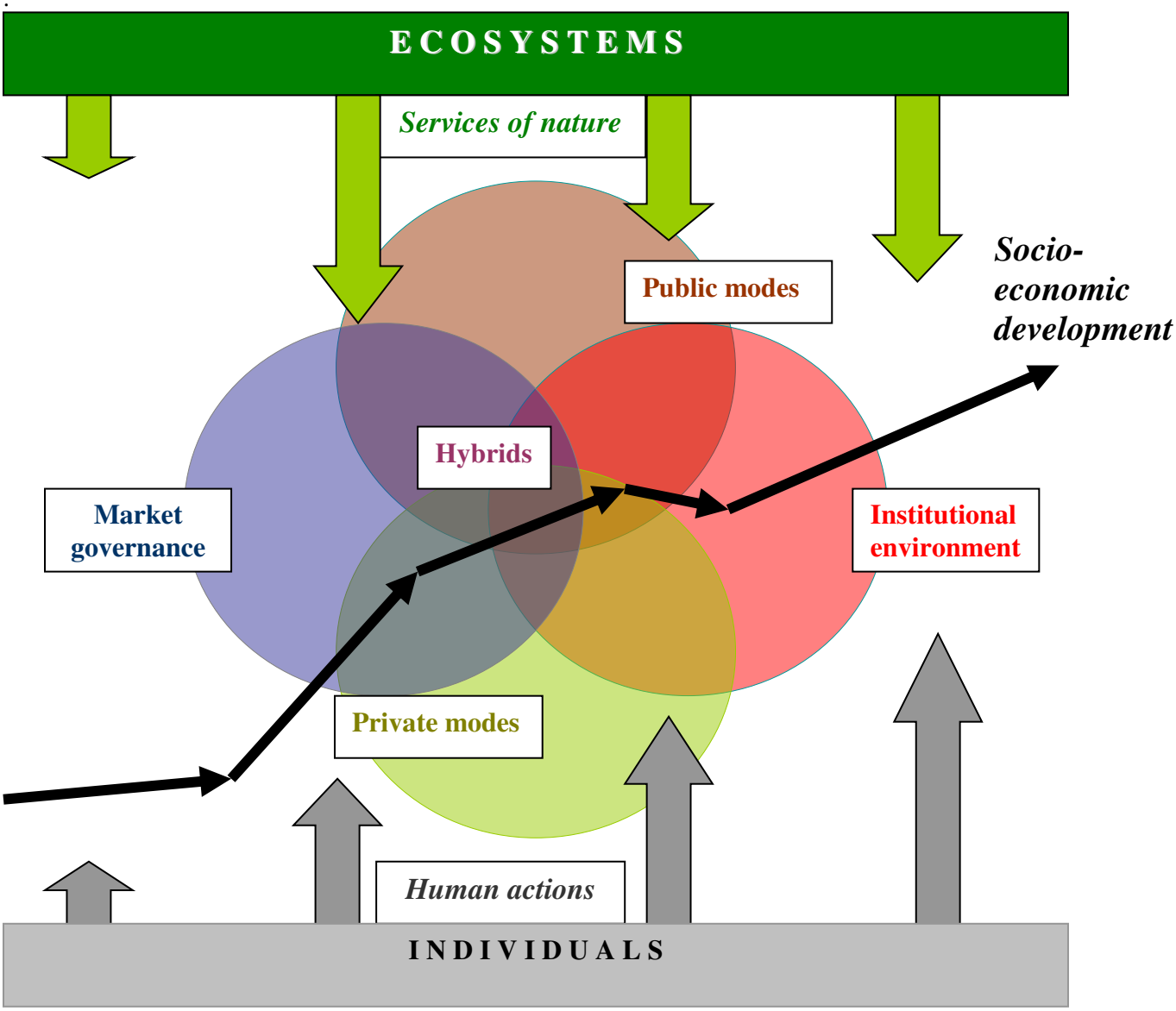
Generally, ecosystem services are classified into following groups (MEA):

- *provisioning services* as food; water; pharmaceuticals, biochemicals, and industrial products; energy; genetic resources;
- *regulating services* like carbon sequestration; climate regulation; waste decomposition and detoxification; purification of water and air; crop pollination; pest and disease control; mitigation of floods and droughts;
- *supporting services* like soil formation; nutrient dispersal and cycling; seed dispersal; primary production;
- *generation and maintenance of biodiversity;*
- *cultural services* as cultural, intellectual and spiritual inspiration, recreational experiences, scientific discovery.

Agro-ecosystem services comprise the ecosystem services provided by the agro-ecosystems. The later are commonly defined as spatially and functionally coherent units of agricultural activity incorporating the living and nonliving components and their interactions (AEHP; Shiferaw *et al.*). That implicitly includes as a key component the *agricultural activity* such as crop production, raising animals, natural resource management (land modification, set aside measures) etc. According to their specific characteristics and the goals (and levels) of the analysis, the *boundaries* of individual agro-ecosystem could be a part of a separate farm (e.g. a cultivated parcel, a meadow, a pond), located in numerous farms, or cover a larger region in a country or (sub)continent. Moreover, the individual agro-ecosystem could include, be a part, or overlap with other ecosystems - dryland, mountain, coastal, urban etc.

The quality and the amount of (agro)ecosystem services depends on the natural evolution of ecosystems and the development of human society (Figure 1). Unprecedented progress in science and technologies has augmented enormously human capability to benefit from the diverse services of nature. At the same time, the growing demand for natural resources and increased pressure on environment have been associated with immense degradation of ecosystems (overuse, pollution, destruction, reengineering) and reduction of related services (MEA). That leads to increased individuals and public concerns about the state of environment and enhanced actions for environmental conservation. What is more, traditional goals of socio-economic development have been expended incorporating environmental sustainability as an essential part (Raman; UN).

Figure 1: Governing mechanisms for ecosystem services



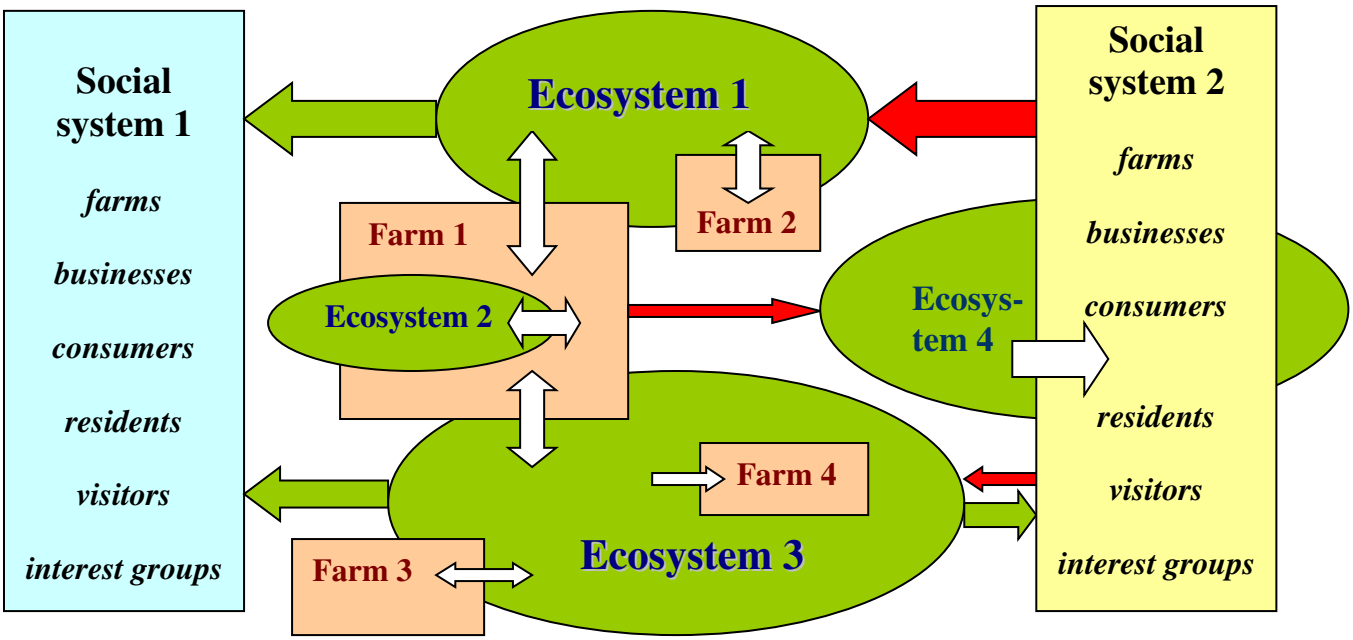
Maintaining the agro-ecosystem services flows requires an effective *social order* (governance) which will induce the *appropriate behavior of individuals*[1] and the *coordinated actions* at various (individual, organizational, community, regional, national, transnational) levels (Bachev, 2009). According to the (awareness, symmetry, strength, harmonization costs of) *interests of agents* associated with the agro-ecosystem services (consumers, contributors, transmitters, interest groups etc.) there are different *needs for governing of actions*.

Various governance needs for the effective supply of agro-ecosystem services are presented in Figure 2. The Farm 1 has to govern its *efforts* and *relations* with the Farm 2 since both receive services from the Ecosystem 1 and affect (positively or negatively) service supply of that ecosystem. Besides, both farms are to govern their relations with the consumers of services from the Ecosystem 1 (agents in the Social system 1) to meet the *total demand* and *compensate costs* for maintaining ecosystem services to that direction. In addition, the Farms

[1] "pro-environmental" actions, "anti-environmental" inactions.

1 and 2 have to coordinate efforts with agents in the Social system 1 to *mitigate conflicts* with the agents in the Social system 2 (affecting negatively services of the Ecosystem 1). Furthermore, the Farm 1 is to govern its relations with the Farm 3 for effective service supply from the Ecosystem 3, and manage its interaction with the Ecosystem 2. Moreover, the Farms 1 and 3 have to govern their relations with the Farms 4 and the agents from Social system 1 (consumers of services of the Ecosystem 3) and Social system 2 (consumers and destructors of the Ecosystem 3 services). Finally, the Farm 1 affecting adversely the Ecosystem 4 services is to govern relations with the agents in the Social system 2 (consumers of the Ecosystem 4 services) to reconcile conflicts and secure effective flow of ecosystem services. Therefore, the Farm 1 is to be involved in *seven* systems of governance in order to assure an effective supply of the services from ecosystems of which it belongs or affects.

Figure 2: Governance needs for effective supply of agro-ecosystem services



Similarly, for the effective governance of the Ecosystem 1 services there are necessary *five* governing modes – for coordination of actions of the Farms 1 and 2; the agents in Social system 1; the Farms 1 and 2 with the Social system 1; the agents in Social system 2; the Farms 1 and 2 and the Social system 1 with the Social system 2.

Individuals behavior (actions) are affected and could be governed by a number of *distinct* modes and mechanisms including:

– *the institutional environment (the "rules of the game")* – that is the distribution of rights and obligations between individuals, groups, communities and generations, and the system(s) of enforcement of these rights and rules. In the modern society a great deal of the individuals activities and relations are regulated by some (general or more specific) formal and informal rules. However, there is no perfect system of preset outside rules that can govern effectively the entire activities of individuals in all possible (and quite specific) circumstances of their life and relations.

– *the market modes* – those are various decentralized initiatives governed by the free market price movements and market competition (e.g. spotlight exchanges, classical contracts, production and trade of organic products and origins, system of fair-trade etc.). The importance of the "invisible hand" of market for the effective coordination and stimulation of individuals activities has been one of the fundamentals of the modern economy and development policies. However, there has been also a great number of "market failures" compromising the sustainable development and leading to social crisis, economic crisis, ecological crisis, energy crisis etc.

– *the private modes ("private or collective order")* – those are diverse private initiatives, and specially designed contractual and organizational arrangements governing bilateral or multilateral relationships between private agents (e.g. voluntary individual or collective actions, codes of professional behavior, environmental contracts, eco-cooperatives etc.). There has been emerging a great number of private and collective forms managed by the "visible hand of the manager", collective decision-making, private negotiations etc. governing successfully various aspects (and challenges) of the sustainable development. Nevertheless, there exist abundant examples of "private sector failures" (lack of potential to coordinate and stimulate activity) demonstrating the incapability to deal effectively with the problems of ecosystem services.

– *the public modes ("public order")* – these are various forms of a third-party public (Government, community, international etc.) intervention in market and private sectors such as public guidance, public regulation, taxation, public assistance, public funding, public provision etc. The role of the public (local, national and transnational) governance has been increasing along with the intensification of the activity and exchange, and the growing interdependence of the social, economic and environmental activities (and related problems and risks). In many cases, the effective organization of certain activity through a market mechanism (price competition) and/or a private negotiation would take a long period of time, be very costly, could not reach a socially desirable scale, or be impossible at all. Thus a centralized public intervention could achieve the willing state of the system faster, cheaper or more efficiently. Nonetheless, there has been a great number of bad public involvements (inaction, wrong intervention, over-regulation etc.) leading to significant problems in the ecosystem services around the globe.

– *the hybrid forms* – some mixture combining features of the market and/or private and/or public governance - e.g. the state certifies the organic producers and enforces the organic standards, and thus intensifies the development of organic markets and supply of ecosystem services.

In *one person* world there is *no* need for (any) governance since the sustainable relations between that person and the nature are achieved through a simple (production and/or consumption) management *("self-governance")*[2]. However, in the real world of limited resources, complex social interactions between many individuals (division, specialization and cooperation of labor, intensive exchanges) and conflicting interests, there is a need for a *special governing mechanism* to direct, coordinate, stimulate, induce and enforce individuals efforts to accomplish a sustainable development. As far as agro-systems (services) are concerned, *the lowest* (the first) level of governance is *the farm*[3] while the highest level could be a global governance.

[2] as might be the case of a single subsistence farm in a remote depopulated location interacting with ecosystem(s) of just local importance to that particular farm (no market, contract or public governance).

[3] In modern economy the farm is not only production but a major *governance structure* (Bachev and Peeters). What is more, the (one-person, family, cooperative, corporative etc.) farm is the *smallest scale* (the first level of) governance in agriculture, and eco-assessments and eco-management at *lower*

Depending on the *efficiency of the system of governance* which is put in place, the *outcome* of the development is quite different with diverse levels of socio-economic progression (Figure 1). Consequently, all systems for assessment of agro-ecosystems sustainability *must* include not only the "current" level (the state) of agro-ecosystem services supply. The evaluation is to embrace the *system of governance(s)*, that is the *social mechanism* responsible for the evolution (outcome) of agro-ecosystem services. Otherwise, mere analysis of the state or trend indicators would give no adequate picture for the ability of the system to improve, sustain, or adapt to a new sustainable level (Bachev, 2009).

Thus the problem for *assessing* the efficiency (potential, limits) of *individual* governing modes and mechanisms, and for selecting *the most efficient* one(s) for the specific conditions of a particular agro-ecosystem is very important.

(e.g. parcel, plot, ecosystem) levels are to *support* rather than be considered as *units of* the agro-ecosystem *governance*.

2. Economics of agro-ecosystem services

The *problem* of effective supply of ecosystem services (and sustainable development in general) is an important part of the economic theory. Most often it is discussed in relation to (in)efficiency of using common natural resources ("tragedy of commons") (Hardin), and the "public good" character (Samuelson) and "negative externalities" (Pigou) associated with some activities. More recently, it is increasingly associated with the "multi-functionality" (joint production character) of agriculture, and the "economic evaluation" of environmental goods, actions, and costs.

When common ownership and "open access" to natural resources exists, there is tendency for inefficient use ("overuse") of resources. For example, there are certain natural limits for "sustainable" exploration of a meadow for livestock farming or a pond for irrigation. The long-term efficiency (output) would decrease if number of the grazing animals or water use increase beyond these norms of an effective natural reproduction. In a one-person farm or private ownership, there will be no conflict between the efficiency and sustainability. Here maximization of the output over time will be always achieved through a "simple" production planning and management.

However, in a situation of *multiple users* and *open access,* there are strong individual interests for overusing the common resources since the private costs are not proportionate to the private benefits. In that case, individuals get full output from increasing the number of animals (or utilized water) while bear a small portion of the overall decrease in the total yield as a result of the over-exploitation. Consequently, a constant overuse (non-sustainability) and a low long-term efficiency come out as a result of this form of organization of natural resources. In the modern (globalize) world a great number of the natural and environmental resources have been increasingly affected by the "tragedy of commons", and the water crisis, biodiversity crisis, global warning etc. are top on the agenda.

Nonetheless, the "*tragedy"* of commons could be avoided by an alternative institutional arrangement. For instance, an introduction of a public regulation on the exploitation of natural resources, such as distribution (and enforcement) of quotas for farmers and water users, would keep sustainability. In other instances, the privatization of natural resources would be an effective solution since it would create strong private incentives for the long-term preservation of resources. In the later case, a private agent (the owner) will regulate, contract, and control an effective and sustainable use of the limited natural resources.

Another classical case of "market failure" for the allocation and sustainable use of natural resource is caused by the *negative (positive) externalities* of certain activities. The free-market prices do not always reflect the effect on third party's welfare, and that is why they cannot govern effectively the resource allocation and uses. For instance, the price of livestock products does not comprise the costs of the pollution of underground water by the farm activity. Since private agents (farmers, consumers of farm products) do not pay the full price and the costs associated with their activity, they are not interested in the most effective (and sustainable) use of natural resources.

Most of the (agro)ecosystem services also have *public (collective) goods character.* Since consumption of a public good by one individual does not reduce availability to others *(non-rivalrous)* and nobody can be excluded from using that good *(non-excludable),* the activity of public good production could not be effectively governed through market and

private modes (market failure *and* private sector failure). Consequently most public and collective goods such as maintaining biodiversity, carbon sequestration, water and air purification services etc. are not supplied at socially desirable scale.

In case of the public good and the (broader) externality "problem" the maximization of the social output and welfare cannot be achieved, and an inefficient allocation and overuse of resources, and unsustainable development come out as a result. Hence farmers will over-produce "public bads" and negative externalities (noise, air, water pollution) and under-produce "public goods" and positive externalities (rural amenities, ecological and cultural services; biodiversity). Subsequently the efficiency and sustainability of some elements of the system (e.g. farms) are in conflict with the efficiency and sustainability of the other elements of the system (e.g. consumers) or the system as a whole.

Therefore, an elimination of the *differences* between the *"social"* and the *"private"* prices ("internalization of externalities") through taxes, norms etc. is commonly suggested. Besides, various *monetary methods*[4] for the evaluation of (contribution to) the natural "capital" and the environmental costs are suggested in analysis of the overall efficiency[5]. For example, the economic value of environmental services ("positive impact") of UK agriculture is estimated to 595 million pounds a year, while damages to natural capital (negative impact on water, air, soil, biodiversity and landscape) reaches 1072 million (Hartridge and Pearce).

The monetary assessments help decision-making and increase public awareness about the benefits of natural ecosystem and the costs of their destruction. At the same time, the effectiveness of suggested methods is questioned because the role and services of the natural resources are not always known, and the entire "social" (present and future) value could be rarely properly evaluated. Besides, financial calculations of the non-replicable part of the ecosystem services[6] and most of the negative externalities do not often make sense. For instance, the adverse "impact" on human health and life, and the "value" of lost biodiversity, and the "exhausting" of non-renewable resources etc. are *not socially acceptable* (no "trade-off" is possible). Having in mind all these uncertainties there are calls for establishing fundamental ecosystem protection rights and new institutions encouraging the participation in ecosystem preservation.

Coase has proved that the *problem of "social costs"* does not exist in a world of zero transaction costs and well-defined private rights (Coase, 1960). The situation of maximum efficiency is always achieved independent of the initial allocation of rights. If for instance, a farmer has the "right to pollute", the affected agents would pay him an appropriate "bribe" (equal to the lost income or welfare) to stop polluting activity. If the opposite is true and the farmer does not have the "right to pollute", then farmer would pay the appropriate bribe to other agents to let him certain pollution. In either case, all mutual beneficial transactions take

[4] Most popular methods are: *Avoided Cost* (services allow society to avoid costs that would have been incurred in the absence of those services); *Replacement Cost* (services could be replaced with man-made systems); *Factor Income (s*ervices provide for the enhancement of incomes); *Travel Cost* (service demand may require travel, whose costs can reflect the implied value of the service); *Hedonic Pricing* (service demand may be reflected in the prices people will pay for associated goods); *Contingent Valuation* (service demand may be elicited by posing hypothetical scenarios that involve some valuation of alternatives).

[5] In addition, various *non-monetary* assessments are becoming increasingly popular such as eco, carbon, energy, water etc. "footprints" of products and activity.

[6] Experiments such as "Biosphere projects" demonstrated the tremendous expense and difficulty in replicating lost ecosystem services (Daily *et al.*).

place, the welfare of all agents is maximized and the maximum efficiency (known as "Pareto optimum") reached without a need for any public intervention.

In a situation of minor transaction costs the *mode of governance* would not be of economic importance (Williamson). Individuals could coordinate and stimulate the environmental conservation and consumption activity with *equal efficiency* though free market, or through private organizations of different types, or in a single nationwide hierarchy. All information for the effective exploitation of natural and technological opportunities, and satisfying various demands would be *costlessly* available. Individuals would easily coordinate activity and exchange rights in mutual benefit until exhausting possibilities for maximizing social welfare (productivity, consumption, supply of ecosystem services[7]).

However, when *transaction costs* are significant, then costless negotiation, exchange and protection of individuals rights is not possible. Therefore, the *initial allocation of property rights* between individuals (groups) is critical for the overall efficiency and sustainability. For example, when rights on critical resources or activities are not hold by the most efficient user that could significantly impede development – constant conflicts between water-source (or land) owner and water users (farmers).

What is more, when important rights are *not well-defined and/or enforced* then the high costs could block the efficient use of resources and/or (mutually) beneficial activity and exchange. For instance, if "rights on sustainable environment" are not well-defined that creates big difficulties in effective ecosystem service supply – costly disputes between polluting and affected agents; disregards of interests of certain groups or generations etc.

Consequently, the *institutional structures* (distribution and enforcement of rights) for carrying out the agrarian activities become an important factor, which eventually determine the outcome of the system (the efficiency) and the type of the development (sustainability).

"Jointness of production" is a fundamental characteristic of farming. The classical example is when a market-oriented farm produces "multiple products" such corn and hogs, and feed corn to the hogs. That is caused by the opportunities for more productive use of resources (economy of scale and scope) or as a risk reduction strategy of the farm manager (diversification, integration of critical activity etc.). In modern farming there are also outputs, which are less desired such as wastes, (soil, water, air, noise) pollution etc. And finally, the farming output consists of both "private" and "public goods" such as food, rural amenities (hunting, landscape etc), ecological and cultural services, habitat for wildlife, biodiversity etc. A great part of the farm's "non-commodity" outputs is "not-separable" from the major farming activities. Moreover, for these (public, quasi public, collective) goods no markets exist or markets function very poorly. Since these outputs are not "tradable" (profitable) the farmers have no incentives to produce them in a socially demanded scale. For the effective execution of such "public" functions of farms and for the production of the appropriate amount of the positive *and* negative externalities by agriculture it is necessary to develop and apply other *(non-market)* modes for governance.

The *division* and *specialization of labor*, and related *exchange* and *cooperation,* open up enormous opportunities for increasing productivity and welfare of individuals and society[8]. They let "producing" *additional value* (better resource management, bigger output, maximum economies of scale and scope) and creates incentives for deepening individuals specialization

[7] There is a principle *agreement ("social contract") for global sustainable development*. Nevertheless, the *specific* individuals and public demand *(value)* of ecosystem services depends on the state of socio-economic development, endowments with natural resources, awareness of environmental challenges, and dominating institutions in different communities, regions and countries.

[8] The economic advantages from division, specialization and cooperation of labor at national and international scale have been among the fundaments of the Political Economy for more than 200 years.

and exchanges *including in ecosystem services activity*. However, it also increases (*inter)dependency* between individuals (demand, opportunistic behavior, monopoly situation) replacing or minimizing the traditional "dependence from nature". What is more, the former dependency is no anymore restricted to sectoral and national borders. For example, the level of agrarian sustainability in certain countries or regions of South America, Africa and Asia is heavily dependent on development of biotechnology, state of the economy, funding or demand for specific (low-cost, origins, organic, fair-trade) products in North America and Europe.

Farming specialization is also responsible for some environmental problems in certain countries and regions such as soil degradation (practicing constant mono culture); destruction of biodiversity; waters, soils and air pollution (enormous livestock and manure concentration); water shortages (big water demand); adverse impact on valuable eco-systems (e.g. tropical rainforests, river basins) etc.

Above and beyond, the specialization and exchange is associated with *additional (transaction) costs.* The genial insight of Coase that there are "costs of using the price mechanism" (Coase, 1937) reshaped fundamentally the modern economic thinking[9]. The high costs of outside exchange make it more profitable to carry out division and cooperation of labor (a transaction) *within an organization (*such as firm or cooperative) instead across the market. For instance, a specialized organic farm integrates eco-processing, eco-marketing, or eco-tourism activity (hiring new assets and additional labor) because of the significant costs and risks for market trading of ecosystem services.

Nevertheless, the internal management of transactions is also associated with costs (for directing, stimulating and supervising hired labor; for coordination and controlling activity of partners) which restricts unlimited expansion of the borders of an organization[10]. Thus a transaction will be carried *in an organization* if the costs are lower than for governing that transaction *across market* or in *another organization.*

Consequently, the *distribution of overall (agrarian) activities* between different *farms, organizations, and markets* will be determined by the *comparative costs* for using various governing arrangements as the *most efficient one(s)* (minimizing internal *and* external transaction costs) will tend to *prevail*. Moreover, both *(current) costs for using* individual transacting forms and the *long-term costs for their development* (initiation, maintenance, modernization, liquidation) have to be taken into account (Bachev, 2004).

The "discovery" of transaction costs significantly changed the way the economic problem (namely the "effective allocation of resources") is addressed and solved: "Indeed it is obvious that once there is shift from a "frictionless" universe scare resources have to be used to effect transactions, protect property rights and so on. This means that system's total resource endowment can no longer be devoted solely to the production of normal commodities" (Dahlman).

The recognition of transaction costs has also a number of important *policy implications*. *Firstly*, the role of the government is to establish institutions facilitating and intensifying market and private transactions – for identification, protection, and disputing individual (absolute and contracted) rights; quality, labor eco etc, standards; appropriate market

[9] If transaction costs were zero then the governance of production and other (e.g. environmental preservation) activity could be done through *direct* interactions between individuals on market *without any internal or collective organization.*

[10] Otherwise all agrarian activity could be managed in a singe nationalwide company. Actually, that experiment was made and failed in former communist countries in East Europe.

infrastructure and information etc. *Secondly,* when high transaction costs impede or block otherwise efficient transactions the government is to intervene through assistance, regulations, funding, provision etc. to make that *socially desirable activity*[11] possible or more efficient. *Third,* public involvement in market and private activity is to be undertaken *only* if there is a *net benefit* (saving on transaction costs) comparing to total (implementing *and* transacting) costs of public intervention.

The principal role of the governance for the character and the pace of development is recognized (*"governance matters"*) and intensively studied (Coase; North; Furuboth and Richter; Williamson). The specific *institutional environment* in which activity takes place eventually determines the level of economic performance and the sustainability in different industries, regions, countries or periods of history. The factors for the emergence and evolution of various types of institutions are quite *specific* for each society (community), and require a *multidisciplinary* analysis and explanation (North). In the long-run, the institutions are *endogenous* parameters of the system and the *institutional "development"* is to be included in the model along with the economic, social and environmental components.

In the *specific natural, economic* and *institutional environment* individuals develop and use diverse *effective* (market, private, hybrid) modes to govern their relations. However, individual modes have *unequal efficiency for supplying ecosystem services* since they posses unlike potential to decrease bounded rationality, induce individual and collective efforts, safeguard investment, protect and dispute rights, facilitate exchange, coordinate actions, save transacting costs, adapt to changing natural and institutional environment (Bachev, 2007).

Often, the imperfect institutional environment and the high costs of market and private governance block otherwise effective for all sides (socially desirable) eco-activity. There is a need for a third-party *public intervention* (assistance, regulation, arbitration) in individuals transactions to make them more efficient or possible. Nonetheless, public involvement is not always effective (delayed, under-, over-intervention) and as a result of the "public failures" agrarian "development" is substantially deformed (Bachev, 2004).

When market *and* private sector "fail", *and* effective public intervention is not put in place, environment conservation (improvement) activities would not be carried at (socially) effective scale, and supply of ecosystem services diminished bellow practically possible level. In Bulgaria for instance, there has been numerous "government failures" during post-communist transition now. Consequently, ineffective farming organization with significant environmental problems sustain in agriculture[12].

Today "multi-functionality" of agriculture is socially recognized, and the sustainability is considered both as a *criteria* and a *goal (outcome) of the development*. It is also recognized that sustainability cannot be effectively achieved as a "side result" of totally decentralized actions (free market competition, private contracting, collective initiatives). The sustainable development requires *effective governing* and *enforcement mechanisms* including a significant *public* involvement in market and private activities at local, national, transnational and global levels.

Therefore, analysis of the *governance mechanisms* for agro-ecosystem services becomes essential both for defining the efficiency (potential and limits) of market competition and private sector initiatives as well as for designing the most effective modes for public (Government, international etc.) interventions in agrarian sector.

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[11] The particular *value* (and priority) that individual communities and societies give on diverse agrarian *resources, activities, outputs* and *services* are quite *specific at any moment of time.*

[12] Ineffective farming structures, degradation of farmland, pollution of surface and ground waters, loss of biodiversity, and significant greenhouse gas emissions, are typical (Bachev, 2008).

3. Institutions, transaction costs and personality matters

Institutions are the "rules of the game", and they determine the individuals' rights in society and the way the property rights[13] are enforced (Furuboth and Richter; North). The spectrum of rights could embrace the material assets, natural resources, intangibles, certain activities, labor safety, clean environment, food security, intra- and inter-generational justice etc. A part of the property rights are constituted by the *formal* laws, regulations, standards, court decisions etc. In addition, there are important *informal* rules determined by the tradition, culture, religion, ideology, ethical and moral norms etc. The *enforcement* of various rights and rules is done by the state (administration, court, police) or other mechanisms such as community pressure, trust, reputation, private modes, self-enforcement etc.

The institutional analysis is not interested in de-jure rights but *de-facto* rights individuals and groups possess. For instance, the "universal principles" of sustainable development have been declared (1992 Rio Earth Summit) and accepted by most countries. However, the extend of adaptation and respecting of related rights, and their practical enforcement vary significantly among countries.

The *specific* institutional environment affects human behavior and directs (*governs*) individuals' activities "in a predictable way" (North). It creates dissimilar *incentives, restrictions* and *costs* for intensifying exchange, inducing private and collective initiatives, developing new rights, decreasing divergence between social groups and regions, responding to ecological and other challenges etc. For example, (socially) acceptable norms for use of plant and livestock (animal welfare, preservation of biodiversity, GM crops), and environmental resources (water use rights; permissions for pollution), all they could differ even between various regions of the same country[14]. Namely the specific institutional structure eventually determines the *potential for* and the particular *type of* development in different communities, regions, and countries[15].

The *institutional "development"* is initiated by the public authority, international actions (agreements, assistance, pressure), and the private and collective actions of individuals. It is associated with the modernization and/or redistribution of the existing rights; and the evolution of new rights and novel (private, public, hybrid) institutions for their enforcement. For instance, the sustainability initially evolved as "movements" and a "new ideology" in developed countries Afterward this "new concept" extended and instituted in the body of formal laws, regulations and public support programs. Numerous decentralized initiatives of producers and consumers have been wide-spreading in recent years (e.g. codes of ethical behavior, organic farming, system of fair-trade etc.) being an important part of (pushing up) the institutional modernization in the area of ecosystem services.

The diverse *institutional environment* contributes to a different extend to achieving economic, social, environmental etc. goals of the sustainable development. If for instance, the

[13] While lawyers distinguish between property and human rights, for the economists *all rights are propertory rights* (Furuboth and Richter).

[14] In Valonia for instance, the environmental standards are much more restrictive than in other two Belgium regions - Flandria and Brussels (Sauvenier *at al.*).

[15] A major reason for transforming the communist system in East Europe was the low incentives for innovation, increasing productivity, and effective exploitation of environmental resources, in economies based on (quasi)public ownership on material, intellectual and natural capital.

private rights are not well defined, enforced, or are restricted, that would limit the intensification of exchange and the overall socio-economic development. The classical examples for the importance of institutional structure are associated with already mentioned "tragedy of commons" and negative externalities. In certain cases the important role of institutions on agrarian sustainability can even be observed from the sky[16].

Thus the *"institutions matter"* and the analysis of sustainability is to be done in the *specific institutional* rather than in an unrealistic ("normative", desirable) *context*. The weakness of the later approach has been strongly criticized: "The view that now pervades much public policy economics implicitly presents the relevant choice as between an ideal norm and an existing "imperfect" institutional arrangement. This nirvana approach differs considerably from comparative institution approach in which the relevant choice is between alternative real institutional arrangements. In practice, those who adopt the nirvana viewpoint seek to discover discrepancies between the ideal and the real, and if discrepancies are found, they deduce that the real is inefficient. Users of the comparative institution approach attempt to asses which alternative real institutional arrangement seems best able to cope with the economic problem" (Demsetz).

Nevertheless, the institutional aspect is commonly missing in most of the suggested frameworks for analyzing (assessment) of agrarian sustainability in general and agro-ecosystem services in particular. Accordingly, non-feasible norms rather than the real-life arrangements are used as criteria – e.g. the farming model in other (e.g. developed, neighboring) countries, the assumption for perfectly defined and enforced property rights, the effectively working public (local, state, inter-governmental) organizations etc. Therefore, an analysis of the *structure* and the *evolution* of the real or other feasible institutional arrangements for carrying out the agrarian activities have to be included in the model (Bachev, 2004).

Transaction costs are the costs associated with the protection and the exchange of individuals' rights (Furuboth and Richter). In addition to the traditional production and environmental preservation costs, the economic agents make significant costs *for the coordination of their relations with other agents (individuals, private entities, public authorities)*[17]. For example, farmers have enormous costs for finding best prices and partners for land and inputs supply, financing, and marketing of outputs and services; for negotiating the conditions of exchange; for completing, "writing down", registration of contracts; for setting up a partnership organization (coalition); for coordination through a collective decision-making or direct managerial orders; for enforcing negotiated terms through monitoring, controlling, measuring and safeguarding; for disputing through a court system or another way; for adjusting or termination along with the changing conditions of exchange.

The *institutional environment* considerably affects the level of *transaction costs of individual* agents. For instance, when private rights are well defined and protected, and (public) system for contract enforcement work well - that facilitates transactions between individuals and the effective allocation of resources. (The "development" of) institutional

[16] For foreign visitors it was striking to see the large areas of abandoned agricultural lands and dispersed small-plots farming during transitional "institutional vacuum" in Bulgaria (in sharp contrast with countries with well defined property rights). Good satellite images of "outcomes of eco-management under different institutional settings" have been presented at recent NATO ARW showing the dissimilar levels of intensification of farming in both sides of USA-Mexico border (Rochon) and the positive eco-results after introduction of property rights on trees in Niger in 1990s in distinction to neighboring Nigeria (Staes).

[17] The *production costs* are the cost associated with the proper *technology* (combination of production factors) of certain farming, servicing, environmental etc. activity. The *transaction costs* are the costs for governing the economic and other *relations* between individuals.

environment also *imposes significant transaction costs* to agents – e.g. for studying out and complying with various new institutional restrictions (community or state norms, regulations, standards etc.), formal registration of contracts and entities, efforts to deal with bureaucracy etc. A good example in this respect are current problems of many Bulgarian farms to meet the new EU requirements ("institutionally determined" costs) related to new product quality, food safety, labor, environmental, animal welfare etc. standards (Bachev, 2008).

The transaction costs have two *behavioral origins:* individual's *bounded rationality* and *tendency for opportunism* (Williamson). The economic agents do not possess full information about the system (opportunities, adverse effects of their activities on others, trends) since the collection and the processing of such information would be either very expensive or impossible (e.g. for future events; for partners intention for cheating; time and space discrepancy between individual action and adverse impacts on others etc.). In order to optimize decision-making (to reach the state of efficiency and sustainability) they have to spent costs for "increasing their imperfect rationality" - for data collection, analysis, forecasting, training etc.

The individuals are also given to opportunism and if there is an opportunity for some of the transacting sides to get non-punishably an extra rent from the exchange (performing *unwanted* by others exchange) he will likely "steal" the rights of others. Two major forms of opportunism can be distinguished: *pre-contractual* ("adverse selection") - when some of the partners use the "information asymmetry" to negotiate better contract terms; and *post-contractual* ("moral hazard") - when some counterpart takes an advantage of impossibility for full observation on his activities (by another partner or by a third party) or when he takes "legal advantages" of the unpredicted changes in transacting conditions (costs, prices, natural and institutional environment etc.).

A special third form of opportunism occurs in the *development of large organizations* (known as "free-riding"). Since the individual benefits are often not proportional to the individual efforts, everybody tends to expect others to invest costs for the organizational development and later on to benefit ("free riding") from the successful new organization (Olson).

Commonly, it is very costly or impossible to distinguish the opportunistic from non-opportunistic behavior (because of the bounded rationality). Therefore, agrarian agents have to protect their rights, investment and exchanges from the hazard of opportunism through: *ex ante* efforts to protect their "absolute" (given by dominating institutions) rights, and find a reliable counterpart and design an efficient mode for partners credible commitments to the "contracted" (voluntary transferred) rights; and *ex post* investments for overcoming (through monitoring, controlling, stimulating cooperation) of possible opportunism during contract or activity execution stages.

If transaction costs were *zero* then the mode of the governance would not be of economic importance. Conversely, in the world of positive transaction costs the *type of the governance* is crucial since various modes give unequal possibilities for participants to coordinate activities, and stimulate an acceptable behavior of others (counterparts, dependents), and protect their contracted and absolute rights from unwanted expropriation. Thus the *rational* agrarian agents will seek, chose, and develop such modes for governing of their activities and relations with others which maximize their benefits and minimize their *total* (production *and* transacting) costs. In the *long run* only *efficient* modes for governing of different activities *will prevail* (sustain) in agriculture (Bachev, 2004).

The *technological development* also affects enormously the structure and level of transaction costs. For instance, mechanization and standardization of farming operations, products and services increases bounded rationality of the manager, and diminishes possibility for opportunism of hired labor and counterparts. That leads to the extension of

activities and transactions under a singe management (the farm size) – enlargement both the *internal* transactions (internal division and specialization of labor) *and* the *outside* market and/or contract transacting (procurement, trade, cooperation etc.).

Possibilities that progression and application of modern *production* (e.g. precision farming), t*ransportation, measurement, information, communication etc. technologies* gives to coordinate and intensify transactions and minimize related costs are immense[18] - easy assessment and traceability; on line information, coordination, monitoring, detecting, advise; direct low costs exchanges (expressing demands, finding best prices and partners, negotiating, trading, disputing) and collective actions (coalitions) of interested agents at national and international scales; rapid detection of problems and intervention by the governments and international agencies; full participation of individuals in and control on public decision-making etc.

However, that enormous potential for increasing productivity, effective allocation of resources, conservation of environment, and food security[19] meets the restrictions of imperfect institutional arrangements which eventually slow-sown technological progress, impede individuals (market and private) initiatives and transactions, allow particular agents to benefits from the status-quos, and lead to unsustainable exploitation of natural resources.

In the specific market, institutional and natural environment the "rational" agents will tend to select or design the *most effective form for governing* of their activity and relations (Williamson). However, there is not a singe (universal) mode for an effective organization of *all type* of agrarian activity in *any possible* natural, institutional, and economic surroundings (Bachev, 2004). The reason for that is that individual governing forms have *distinct features* (advantages, disadvantages) in protecting rights and coordinating and stimulating ecosystems related activities.

Moreover, the mode of governance will also depend on the *personal characteristics* of agents - individuals and organizational preferences, ideology, ethical and religious believes, level of training, managerial skills, risk aversion, opportunism, trust etc. For example, there are increasing number of *voluntary* initiatives of farmers, businesses, consumers (such as "codes of eco-behavior", "sustainability movements", "green alliances", "corporate eco-culture" etc.) being an important part of the eco-governance. According to the *personality* of resource owners and the (transacting) *costs* and *benefits* of their coalition, different type of governance of agro-ecosystem services will be preferred – individual or family operation, contracting, cooperation, profit oriented enterprise etc. Expected benefits for agents could range from: increased access to eco-system services; monetary or non-monetary income; profit; enjoyment of agricultural and eco-conservation activities; desire for involvement in environment, biodiversity, or cultural heritage preservation; goals to keep farmland and other eco-resources for next generation etc.

Furthermore, efficiency of the governing mode will depends on the *specific attributes* of each activity and transaction. And the range of variations of specific characteristics of agro-ecosystems and required activities for the effective supply of ecosystem services is enormous.

Therefore, the *individual* transaction and the transaction costs is to be put in the *centre* of the analysis, and the *comparative efficiency* of the feasible modes for governing of *socially desirable* activities in agro-ecosystem services assessed.

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[18] The traditional approach examines technology merely as a *production factor*. In fact technology and its development is important *transaction costs minimizing* factor as well.

[19] The list of prospective scientific and technological innovations that are shaping agrarian sustainability and governance have been identified at recent Foresight 2030 Workshops (COST).

4. Effective modes of governance

In some (rare) cases there is *only one* practically possible form for governance of ecosystem service activity. For example, in Japanese dispersed paddy agriculture water supply could not have been conducted by individual farmers (high interdependency, nonseparability of water use) and since earliest period water use organization developed as public projects (Mori). Similarly, in drylands of Israel the collection and utilization of scare rain water in farming (complementarities and nonseparability of activity) has been done by community organizations for centuries now (Berkowicz).

Often the choice of governing mode is *pre-determined by institutional restrictions* as some forms for carrying out agrarian and eco-activities could be socially unacceptable or illegal in certain countries or period of time[20]. For instance, corporate and cooperative organization of farming is forbidden in many countries; market and private trade of farmland other natural resources, and some ecosystems services is illegitimate; market and private management of certain ecosystems (e.g. national parks and reserves) is not allowed etc.

Generally, there is great variety of *alterative* modes for governing of environmental activity. For instance, a supply of "environmental conservation service" could be governed as: voluntary activity of farmer; though private contracts of farmer with interested (affected) agents; though interlinked contract between farmer and supplier (processor); though cooperation (collective action) with other farmers and stakeholders; though (free)market or assisted by third-party (certifying, controlling agent) trade with special (eco, protected origin, fair-trade) products; though public contract specifying farmer's obligations and compensation; though public order (regulation, taxation, quota); within hierarchical public agency or hybrid form.

Individual governing forms have distinct *advantages* and *disadvantages* to protect rights, and coordinate and stimulate socially desirable activities. *Free market* has big coordination and incentive features ("invisible hand of market"[21], "power of competition"), and provides "unlimited" opportunities to benefit from specialization and exchange. However, market governance could be associated with high uncertainty, risk, and costs due to lack of information, price instability, great possibility for facing opportunism, "missing market" situation.

Special contract form permits better coordination, intensification, and safeguard transactions. However, it may require large costs for specifying provisions, adjustments with evolution in conditions of exchange, enforcement and disputing of negotiated terms.

Internal (ownership) organization allows greater flexibility and control on transactions (direct coordination, adaptation, enforcement, dispute resolution by *fiat*). However, extension of internal mode beyond family and small-partnership boundaries[22] may command significant costs for making coalition (finding partners, design, registration, restructuring), and current management (coordination, decision-making, control of coalition members opportunism).

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[20] Nevertheless, when transaction costs associated with illegitimate governance is not high (possibility for disclosure low, enforcement and punishment insignificant) while benefits are considerable, then the more effective (illegal) modes prevail – large gray or black sectors of economy are common around the globe.

[21] Some ecosystem services are directly priced on market or included in related resource (product) prices – e.g. soil quality, access to clean water, land location (beauty), special origin and quality of products etc.

[22] allowing resource concentration for effective operations – e.g. exploration economies of scale and scope on environmental conservation activity.

Separation of ownership from management (cooperative, corporation, public firm) gives enormous opportunities for growth in productivity and transacting efficiency – internal division and specialization of labor; exploration of economies of scale/scope; introduction of innovation; diversification; risk sharing; investing in product promotion, brand names, relations with customers, counterparts and authorities. However, it could be connected with huge transaction costs for decreasing information asymmetry between management and shareholders, decision-making, controlling opportunism, adaptation. In addition, *cooperative* and *non-for profit forms* suffer from low capability for internal long-term investment due to non-for profit goals and non-tradable character of shares ("horizon problem").

In order to select the *best (most efficient) form* for governing of *a particular* activity we have to assess the *comparative* efficiency of *practically possible* forms for governance of that activity.

In *some cases* the advantages of a certain mode of governance are not difficult to verify - e.g. when it gives *bigger benefits* (achieves the socially desirable/effective scale) or commands *minimum total costs*. In such cases the choice of the most effective form of governance is easy since we can compare *directly* the costs and benefits of alternatives. For instance, carrying out conservation activity in agro-ecosystems is commonly governed by farms rather than by specialized in eco-preservation or ecosystem services (market, private, public) enterprises.

However, in many instances, the direct assessment (and comparison) of the costs and the benefits of the alternative governing arrangements are difficult or impossible to make. That is particularly true for some elements of the transaction costs related to divers governance structures. For instance, it is not easy to specify the costs for finding best partners, for negotiation, for controlling and enforcement of contractual terms, for organizational development, for interlinked transacting, for unrealized (failed) deals etc.

Furthermore, it is often extremely complicated to separate transaction costs from the traditional production (farming, environmental preservation etc.) expenditures[23]. For instance, while executing environmental conservation operations a farmer supervises hired labor; during transportation of organic products he negotiates marketing of output etc.

What is more, component comparison of transacting costs could not always give an idea for the efficiency of organizations. Very often the alternative form *decreases one type* of costs while *increasing another type* transacting costs. For instance, internalization of a transaction (replacement of market with integral mode) is associated with reduction of costs for information supply (overcoming market uncertainty), safeguarding investments from outside opportunism, and permanent (re)negotiations along with changing market, institutional and environmental conditions. On the other hand, it enlarges costs for organizational formation, decision making, integral management, supervising and motivation of hired labor etc.

Moreover, a good part of the transactions in agriculture is governed not by "pure" but through *complex* or *interlinked* modes - e.g. a private farm uses a multipurpose cooperative for environmental management *and* marketing of output; inputs supply is arranged in a "package" with know-how and/or service supply; farm is credited by a processor against provision of eco-services etc.

Thus, it is important to take into consideration the *overall* (total) costs for organization of transactions of different types - *all external* and *internal* transaction costs of an organization. The biggest shortcoming of the few comprehensive studies on efficiency of public environmental contracts (Mettepenningen *et.al.,* 2008; Mettepenningen *et.al.,* 2009) is that they assess only the direct costs for farmers (forgone income, contracting) and/or the

[23] All these *"measurement problems"* make it impossible to extend the traditional Neoclassical models simply by adding a new "transacting activity" (Furuboth and Richter).

taxpayers (public eco-payments) rather than all transaction costs for organization of that mode – total internal (contract preparation and implementation) *and* external costs (dealing with agrarian bureaucracy; payments of fee, fines and bribes) for farms *and* total internal (planning, organization, administration, mismanagement) *and* external (contracting, controlling, disputing) costs of public implementation of environmental contracts.

Besides, it is necessary to take into account the *complementarities* between the individual forms for governing the activities (transactions) of *a particular agent*. For example, in transitional Bulgarian agriculture the high efficiency (and sustainability) of small scale and part-time farming (on one hand) and the production cooperatives (on the other hand) can not be explained without assessing their complementarities in governing (critical) transactions of the same individuals (Bachev, 2006).

Often it is difficult to select a base for comparison in view that the high transacting costs entirely block development of an alternative organization. For instance, markets for environmental services and products did not emerged in Bulgaria during most of the transition and the private organization (voluntary initiatives, integral or contractual forms) was the only possible form for the governance of agro-ecosystem services.

The discrete structural analysis is suggested to evaluate the *comparative efficiency* of the alternative governing forms (Williamson). Here the assessment of the absolute levels of transaction costs of the alternative governing structures is not necessary. This approach aims evaluating the *relative* levels of transacting costs between alternative modes of governance, and selecting that one which most economize on transacting costs.

Following that framework ***first*** we have to identify the *"critical dimensions"* of transactions responsible for the *variation* of transaction costs. The "frequency", "uncertainty", and "asset specificity" have been identified as critical factors of the transaction costs by Williamson (Williamson) while the "appropriability" has been added by Bachev and Labonne (Bachev and Labonne).

When the *recurrence* of transactions *between the same partners* is high, then both (all) sides are interested in sustaining and minimizing costs of their relations (avoiding opportunism, building reputation, setting up adjustment mechanisms). Besides, costs for development of a special private mode for facilitating bilateral (or multilateral) exchange could be effectively recovered by frequent exchange.

When the (environmental, behavioral, institutional) *uncertainty*, which surrounds transactions increases, then costs for carrying out and secure transactions go up - for overcoming information deficiency, safeguarding against risk etc. Certain risks could be diminished or eliminated by a production management or through a particular market mode (e.g. purchase of insurance). However, the governance of most transacting risk[24] would require a special private (collective) form – e.g. trade with origins; providing guarantees; using share-rent or output-based compensation; employing economic hostages; participating in a risk-pooling, inputs-supply or marketing cooperative; a complete integration (Bachev and Nanseki).

The transaction costs get very high when *specific assets for the relations with a particular partner* are to be deployed[25]. The relation specific investments are "locked" in transactions with a particular buyer or seller, and cannot be recovered through a "faceless" market trade or redeployment to another uses. Therefore, *dependant* investment (assets) have to be safeguarded by a special form such as long-term contract, interlinks, hostage taking,

[24] risk of market, behavioral or institutional uncertainty.

[25] Specificity is not a technological but *transacting* characteristic of the assets. In one situation a particular capital (investment) could be highly *universal* (easy deployment to another internal usage or outside trade) while in others - highly *specific* (a big dependency from the relations with a particular counterpart - buyer or seller).

joint investment, or ownership integration. Nevertheless, when *symmetrical* (capacity, site, origin, branding, time of delivery) *inter-dependency* of *investments* or *welfare* of agents exist, then costs of governance are not significant (mutual interests for cooperation).

The transacting is particularly difficult when the *appropriability* of rights on products, services or resources is low. "Natural" low appropriability has most of the agrarian intellectual products - agro-market information, agro-meteorological forecasts, new varieties and technologies, software etc. Besides, all products and activities with significant (positive or negative) externalities are to be included in this group. If the appropriability is low the possibility for *unwanted* (market or private) exchange is great, and the costs for protection of private rights (safeguard, detection of cheating, disputing) extremely high. The agents would either over produce (negative externalities) or under organize such activity (positive externalities) unless they are governed by an efficient private or hybrid mode - cooperation, strategic alliances, long-term contract, trade secrets, or public order.

Secondly, we have to "*align* transactions (differing in their attributes) with the governance structures (differing in their costs and competence) in discriminating (mainly transaction cost economizing) way" (Williamson). According to the *combination* of specific characteristics of each transaction, there will be *different* most *effective form* for governing of ecosystem service activity (Figure 3).

Figure 3: Principle modes for governing of ecosystem service transactions*

Generic modes	***Critical dimensions of transactions***								
	Appropriability								
	High								*Low*
	Assets Specificity								
	Low				*High*				
	Uncertainty								
	Low		*High*		*Low*		*High*		
	Frequency								
	High	*Low*	*High*	*Low*	*High*	*Low*	*High*	*Low*	
Free market	ᛉ	ᛉ							
Special contract form			ᛉ			ᛉ			
Internal organization					ᛉ		ᛉ		
Third-party involvement									
Public intervention									

* *Differences in agents personal characteristics are disregarded. Only extreme levels (high-low) of critical factors are considered. In the real ecosystem services economy there is a big variation of the critical dimensions, and thus of the effective forms of governance*

ᛉ - *the most effective mode*; - *necessity for a third party involvement*

Transactions with good appropriability, high certainty, and universal character of investments could be effectively carried *across free market* through *spotlight* or *classical*

contracts[26]. There are widespread market modes for selling *pure* "ecosystem services" (eco-visits, hunting, fishing, harvesting wild plants and animals) or "ecosystem services" *interlinked* with other products and services (e.g. organic, fair-trade, special origins, on-farm sale, self-pick, eco-education, eco-tourism, horse-riding, eco-restaurants etc.).

Recurrent transactions with low specificity, high uncertainty and appropriability, could be effectively governed through a *special contract*. The *relational* contract is applied when detailed terms of transacting are not known at outset (high uncertainty), and a framework (mutual expectations) rather than specification of the obligations is practiced[27].

The special contract forms is also efficient for rare transactions with low uncertainty, high specificity and appropriability. Here dependent investment could be successfully safeguarded through contract provisions since it is easy to define and enforce relevant obligations of partners in all possible contingencies (no uncertainty). For example, eco-contracts and cooperative agreements between farmers and interested businesses [28] or communities are widely used including a payment for the ecosystem services, and leading to production methods (enhanced pasture management, reduce use of agrochemicals, wetland preservation) protecting water from pollution, mitigating floods and wild fires etc.

Transactions with high frequency, big uncertainty, great assets specificity, and high appropriability, have to be governed *within* internal organization. Very often the effective scale of specific investment in agro-ecosystem services exceeds the borders of traditional agrarian organizations (individual or family farm, small partnership). If specific capital (knowledge, technology, equipment, funding) cannot be effectively organized within a singe organization[29], then effective external form(s) is to be used – joint ownership, interlinks, cooperative, lobbying for public intervention. For instance, environmental cooperatives are very successful in Holland and some other EU countries (Hagedorn). Nevertheless, costs for initiation and maintaining collective organization for overcoming *unilateral dependency* are usually great (big number of coalition, different interests of members, opportunism of "free-riding" type) and it is unsustainable or does not evolve at all.

Third, we have to identify the situations of *market* and *private* sector *failures* – that is the *critical points* for the agro-ecosystems sustainability. Serious problems arise when condition of assets specificity is combined with the high uncertainty, low frequency, and good appropriability of transactions. Here governance of transacting risk would require special private forms – direct marketing, distribution channels, providing guarantees, investing in labels, share-rent (output-based) compensation, employing economic hostages, participating in a risk-pooling cooperative, a complete integration. However, elaboration of a special governance for private occasional transacting is not always justified, specific investments not made and activity (or restriction of activity) fails to occur at effective scale. Similar difficulties are also encountered for rare transacting associated with a high uncertainty and appropriability.

In all these cases, *a third part* (private agent, NGO, public authority) *involvement* in transactions is necessary (through assistance, arbitration, regulation) in order to make them more efficient or possible at all. For instance, when State establishes and enforces quality and safety standards for farm inputs (chemicals, machinery, water) and produces, or certify

[26] Partner can be changed anytime without significant additional costs (no dependency). Private governance would only bring costs without producing any benefits.

[27] Here no big risk is involved since investments could be easily/costlessly redeployed to another use(users).

[28] e.g. drinking water companies in Germany (Hagedorn), and mineral water company Vittel in France (Hanson *et al.*). We discovered such agreements between farmers and Sony, in Kumamoto region, Japan.

[29] coalition made, minimum scale of operations reached, economy of scale/scope explored.

providers of agrarian services, or guarantee minimum farm-gate prices, all that considerably facilitates and intensifies (market and private) transactions and increases farm sustainability. The emergence and unprecedented development of the special origins[30], organic farming and system of fair-trade, all they are good examples in that respect. There is an increasing consumer's demand (a price premium) for the organic, semi-organic and fair-trade products in developed countries. Nevertheless their supply could not be met unless an effective *trilateral governance* (including an independent certification and control) has been put in place.

Governing transactions is extremely difficult when *appropriability* is low. Nevertheless, *respecting* others rights (unwanted exchange avoided) or *granting out* additional rights to others (needed transactions carried out) could be governed by *"good will"* or *charity actions* of individuals, NGOs, government or international organizations. For instance, a great number of voluntary environmental initiatives (agreements) have emerged driven by the farmers' preferences for eco-production, competition in industries, and responds to the public pressure for a sound environmental management[31]. However, the environmental standards are usually "process-based", and "environmental audit" is not conducted by an independent party, which does not guarantee a "performance outcome". Therefore, most of these initiatives are seeing as a tool for the "external image manipulation". Recent huge food safety, animal safety, and eco-scandals have demonstrated that such private schemes could often fail (consequence of the high informational asymmetry and possibility for opportunism).

In any case, the voluntary (charity) initiatives could hardly satisfy the entire social demand especially if they require considerable costs. Some *private modes* could be employed if a high frequency (a pay-back on investment is possible) and a mutual assets dependency (thus an incentive to cooperate) exists[32]. In these instances, unwritten accords, interlinking, bilateral or collective agreements, close-membership cooperatives, codes of professional behavior, alliances, internal organization etc. are used.

Governance of most ecosystem services requires large organizations with diversified interests of agents (providers, consumers, destructors, interest groups). Emergence of special *large-members* organizations for dealing with low appropriability is slow and expensive, and they are not sustainable in long run ("free riding" problem). Therefore, there is a strong need for *a third-party public* (Government, local authority, international assistance etc.) *intervention* to make such eco-activity possible or more effective (Bachev, 2004).

For example, the supply of most "environmental goods" by farmers could hardly be governed through private contracts with the individual consumers because of the low appropriability, high uncertainty, and rare character of transacting (high costs for negotiating, contracting, charging all potential consumers, disputing etc.). At the same time, the supply of additional environmental protection and improvement service is very costly (in terms of production and organization costs) and would unlikely be carried out on a voluntary basis. Besides, the financial compensation (fee, price-premium) of farmers by the willing consumers through a pure market mode is also ineffective due to the high information asymmetry, massive enforcement costs etc. A third-party mode with a direct public involvement would make that transaction effective: on behalf of the consumers the State agency negotiates with the individual farmers a contract for "environment conservation and improvement service",

[30] For instance, "Protected Designation of Origin", "Protected Geographical Indication", "Traditional Specialty Guaranteed" in EU.

[31] Unprecedented development of the "codes of behaviors", eco-labeling and branding, environmental cooperatives, and "green alliances", all they are good examples in that respect.

[32] For instance, inter-dependency between an eco-dairy farm and an eco-milk processor in a remote region (capacity and site dependency); or a bee keeper and a neighboring orchard farm (symmetric dependency between needs of flowers and needs for pollination).

coordinates activities of various agents (including a direct production management), provides public payments for the compensation of farmers, and controls the implementation of negotiated terms[33].

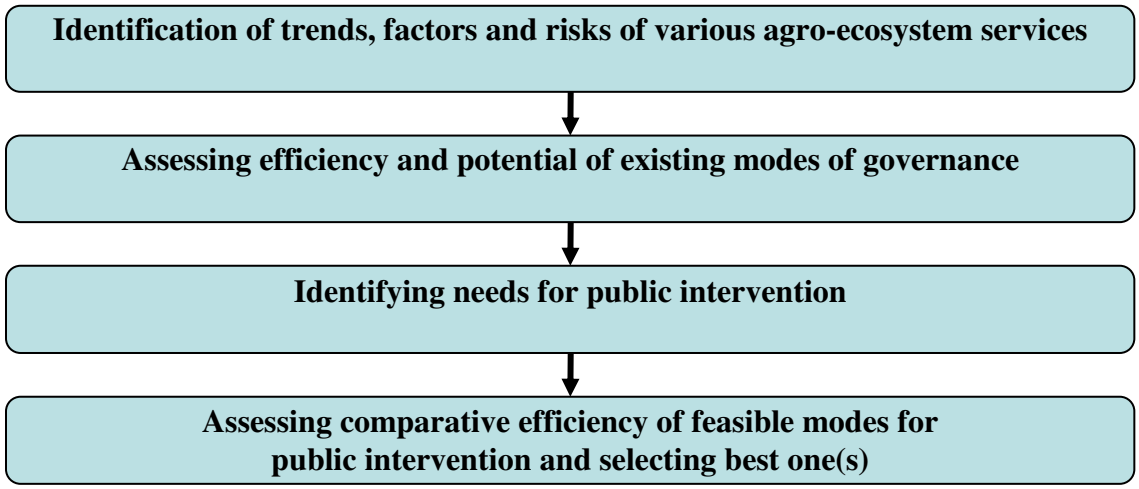
[33] Namely, *public environmental contracts* with individual farmers have been broadly used in EU as an effective form for governing the supply of environmental preservation and improvement services (EC).

5. Improvement of public governance

The *analysis* and the *improvement* of public governance of agro-ecosystems services have to include following steps (Figure 4):

Firstly, we have to identify trends, factors and risks associated with the services of various agro-ecosystems. Modern science offers precise methods to classify diverse agro-ecosystem services (their spatial and temporal scales), and evaluate trends and risks in their evolution, and identify driving ecological and social factors for their progression (Edwards *et al.;* Shiferaw *et al.;* MEA). What is more, it suggests effective methods to improve farming, business and consumption practices in order to mitigate environmental and social hazards on ecosystem services.

Figure 4: Steps in improvement of public governance of agro-ecosystem services



Secondly, we have to access the efficiency and the potential of *existing* mechanisms of governance (institutions, market, private, public) to deal with the *problems* and *risks* for sustainable flow of agro-ecosystem services. It will be based on analysis of *structure* and *dynamics of the* (individuals, groups, public) *interests* in each agro-ecosystem and the *transaction costs* for their communication, protection and reconciliation.

Third, we have to identify *deficiencies* (failures) in dominating *market, private*, and *public* [34] modes to govern effectively the behavior of agents associated with the agro-ecosystem services (consumers, contributors, transmitters, interest groups, authorities). Existing and emerging *transacting difficulties* are to be specified like undefined or badly defined and enforced private rights; bounded rationality and opportunisms of agents; low appropriability and frequency, and high dependency and uncertainty of transactions etc. That helps define *needs* and *types* for new public interventions in agro-ecosystem services.

Finally, we have to identify the *alternative* modes for *new* public intervention able to *correct* market, private and public failures; and assess their *comparative efficiency,* and select the *most efficient* one(s). It is essential to compare *practically* (technically, socially) *possible*

[34] For instance, a major reason for reforming the EU CAP has been "undesired" effects such as over-intensification, environmental degradation, and market distortions.

forms of governance which correspond to *social preferences* for *benefits* to be obtained[35], *instruments* to be used, and *costs* to be incurred.

The comparative efficiency is to be evaluated in terms of *coordination, incentive, conflict resolution and (transaction) costs minimization potential*. Public modes not only facilitate (market, private) transactions but also command significant (public *and* private) costs. That is why the assessment is to comprise *all* implementation *and* transaction *costs* – direct (tax payer, assistance agency) expenses, *and* the transacting costs (for coordination, stimulation, information, control of opportunism, mismanagement) of bureaucracy, *and* the costs for individuals' participation in public modes (adaptation, information, paper works, fees, bribes), *and* the costs for community control over and reorganization (modernization, liquidation) of public forms, *and* the (opportunity) "costs" of public inaction [36].

Depending on *uncertainty, frequency*, and necessity for *specific investment* of the public involvement, there will be different most effective forms (Figure 5). Principally, interventions with a low uncertainty and assets specificity would require a *smaller* Government organization (more regulatory modes; improvement of the general laws and contract enforcement etc.). When uncertainty and assets specificity of the transactions increases a *special contract mode* would be necessary – e.g. employment of public contracts for provision of private services, public funding (subsidies) of private activities, temporary labor contract for carrying out special public programs, leasing out public assets for private management etc. And when transactions are characterized with a high assets specificity, uncertainty and frequency then an *internal mode* and a *bigger public organization* would be needed – e.g. permanent public employment contracts, in-house integration of crucial assets in a specialized state agency or public company etc.

Figure 5: Effective modes for public intervention in agro-ecosystem services supply

LOW APPROPRIABILITY				
Level of Uncertainty, Frequency, and Assets specificity				
Low	←----------		----------→	***High***
New property rights	**Regulations**	**Taxes**	**Assistance and support**	**Public provision**

[35] E.g. behavior to be changed; conflict to be mitigated; risks to be overcome; extend of restoration, preservation, and augmentation of agro-ecosystem services etc.

[36] Value of some *lost* agro-ecosystem services could be expressed in economic terms (e.g. income decline in related industries, substitution or recovery costs, adverse impacts on human welfare etc.). However, a significant social value can hardly be expressed in monetary terms (e.g. adverse impact on biodiversity, other ecosystems, human health, future generations) and non-monetary estimates is to be used.

Rights for clean, beautiful environment, biodiversity; Private rights on natural, biological, and environmental resources; Private rights for (non) profit management of natural resources; Tradable quotas (permits) for polluting; Private rights on intellectual property, origins, (protecting) ecosystem services; Rights to issue eco-bonds, shares; Private liability for polluting	Regulations for organic farming; Regulations for trading of protection of ecosystem services; Quotas for emissions and use of products and resources; Regulations for introduction of foreign species, GM crops; Bans for certain activity, use of inputs, technologies; Norms for nutrition and pest management; Regulations for water protection against nitrates pollution; Regulations for biodiversity and landscape management; Licensing for water or agro-system use; Quality and food safely standards; Standards for good farming practices; Mandatory eco-training; Certifications and licensing; Compulsory eco-labeling; Designating environmental vulnerable, reserve zones; Set-aside measures; Inspections, fines, ceasing activities	Tax rebates, exception, breaks; Eco-taxation on emissions, products; Levies on manure surplus; Levies on farming or export for innovation funding; Waste tax	Recommendation, information, demonstration; Direct payments, grants for eco-actions of farms, businesses, and communities; Preferential credit; Public eco-contracts; Government purchases (water, other limited resources); Price and farm support for organic production, special origins; Funding of eco-training; Assistance in farm and eco-associations; Collecting fees for paying ecosystem service contributors	Research and extension; Market information; Agro-meteorological forecasts; Sanitary and veterinary control, vaccination, prevention measures; Public agency (company) for important ecosystems; Pertaining "precaution principle"; Eco-monitoring; Eco-foresight; Risk assessment

Initially, the *existing* and the *emerging problems* (difficulties, costs, risks, failures) in the organization of market and private transactions have to be specified. The appropriate government involvement would be to create an environment for: decreasing the uncertainty surrounding market and private transactions, and increasing the intensity of exchange, and protecting private rights and investments, and making private investments less dependent etc. For instance, State establishes and enforces quality, safety and eco-standards for farm inputs and produces, certifies producers and users of natural resources, regulates exploitation of eco-resources, transfers water management rights to farms associations, sets up minimum farm-gate prices etc. All that facilitates and intensify (market and private) transactions on agro-ecosystem services (Figure 3).

Next, practically possible modes for *increasing appropriability* of transactions have to be considered. The low appropriability is often caused by unspecified or badly specified private rights (Bachev, 2004). In some cases, the most effective government intervention would be to introduce and enforce *new private property rights* – e.g. rights on natural, biological, and environmental resources; rights on issuing eco-bonds and shares; marketing and stock trading of ecosystem services protection; tradable quotas for polluting; private rights on intellectual agrarian property and origins etc. That would be efficient when the privatization of resources or the introduction (and enforcement) of new rights is not associated with significant costs (uncertainty, recurrence, and level of specific investment are low). That public intervention effectively transfers the organization of transactions into market and private governance, liberalizes market competition and induces private incentives (investments) in eco-activities (the relevant part in Figure 3).

For instance, tradable permits (quotas) are used to control the overall use of certain resources or level of a particular type of pollution[37]. They give flexibility allowing farmers to trade permits and meet their own requirements according to their adjustment costs and specific conditions of production. That form is efficient when a particular target must be met,

[37] E.g. manure production quotas in Holland until recently, water abstraction licenses and water rights trading in UK and Australia, nutrition trading schemes in some US river catchments etc.

and the progressive reduction is dictated through permits while trading allows the compliance to be achieved at least costs (through a private governance). The later let also a *market for environmental quality* to develop[38].

In other instances, it would be efficient to put in place *regulations* for trade and utilization of resources, products and services – standards for product quality, eco-performance, animal welfare; norms for using natural resources, introduction of foreign species and GM crops, and (water, soil, air, comfort) contamination; bans on application of certain chemicals and technologies; regulations for trading ecosystem service protection[39]; foreign trade regimes; mandatory eco-training and licensing of farm operators etc.

A large body of environmental regulations in developed and other countries aim changing farmers behavior and restricting negative externalities. For instance, in EU there are bans for spraying pesticides by airplane, burning after harvest, overhead irrigation of grassland; detailed regulations for nutrition and pest management, water protection against pollution by nitrates, biodiversity and landscape management; licensing for water use etc. Moreover, each country develops "good farming practices" system setting specific codes for sustainable farming.

Eco-regulation makes producers responsible for the environmental effects of their activity or management of products uses (e.g.waste). This mode is effective when general improvement of performance is desired but it is not possible to dictate what changes (in activities, technologies) is appropriate for the wide range of operators and eco-conditions (high uncertainty, information asymmetry). When level of hazard is high, outcome is certain and control is easy, and no flexibility exists (for timing or nature of the socially required result), then bans or strict limits are the best solution. However, regulations impose uniform standards for all regardless of compliance (adjustment) costs and give no incentives to over-perform beyond a certain level.

Sometimes, using incentives and restrictions of *tax system* would be effective form for intervention. Different tax preferences (exception, breaks, credits) are widely used to create favorable conditions for the development of certain sub-sectors, regions, activities, forms of organizations, segment of population etc.

Environmental taxation on emissions or products (inputs, outputs) is also applied to reduce use or leakage of harmful substances. For instance, taxes on pesticides and fertilizer are used in Scandinavian countries and Austria to decrease their application and environmental damaging impact[40]. In Holland, levies on manure surplus were introduced in 1998 based on levies for nitrogen and phosphorus surpluses above a levy free surplus per hectare. The system creates strong incentives to minimize the leakages (and not just usage), and reduce the flexibility to substitute taxable for non-taxable inputs. However, it is associated with significant administrative and private costs[41].

The environmental taxes impose the same conditions for all farmers using a particular input and give *signals* to take into account the *"environmental costs"* inflicted on the rest of the society. Taxing is effective when there is a close link between the activity and the

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[38] Permits can be taken out of market in order to raise the environmental quality above the "planned" (by the Government) level.

[39] One can acquire credits for sponsoring protection of carbon sequestration sources or restoration of ecosystem service providers. Banks for handling such credits are established and conservation companies even gone public on stock exchanges (Daily *et al.*).

[40] In Sweden tax is imposed on manufactures and importers at a fixed rate for active ingredient, and represents 20% of the fertilizers prices. In Denmark a different rate of sale tax is applied on retail prices of chemicals representing an average of 37% of the wholesale prices (ECOTEC).

[41] Annual revenue of 7,3 millions Euro against the administration costs of 24,2 millions and the compliance expenses at farm level between 220-580 per farms (ECOTEC).

environmental impact, and when there is no immediate need to control the pollution or to meet the targets for reduction. Tax revenue is also perceived to be important to maintain budget (activities) of special environmental programs.

However, an appropriate level of the charge is required to stimulate a desirable change in farmers behavior[42]. Furthermore, the nitrogen emission can vary according to the conditions when nitrates are applied and attempting to reflect this in tax may result in complexity and high administrating and private costs. Besides, the distribution impact of such taxes must be socially acceptable, and the implications for international competitiveness also taken into account.

In some cases, *public assistance and support* to private organizations is the best mode. Large agrarian and rural development, environmental and cultural heritage conservation, and trans-border cooperation programs are widely used in all industrialized countries.

The public *financial* support for the environmental actions is the most commonly used instrument for the improving of environment performance of farmers in the EU and other developed countries[43]. It is easy to find a justification for the public payments as a compensation for the provision of an "environmental service" by farmers. All studies shows that value placed upon landscape exceed greatly the costs of running the schemes.

However, the share of farms covered by the various agri-environmental support schemes is not significant[44]. That is a result of the voluntary (self-selection) character of this mode which does not attract farmers with the highest environment enhancement costs (most intensive and damaging environment producers). In some cases, the low-rate of farmers' compliance with the environmental contracts is a serious problem[45]. The later cannot be solved by augmented administrative control (enormous enforcement costs) or introducing bigger penalty (politically and juridical intolerable measure). A disadvantage of "the payment system" is that once introduced it is practically difficult ("politically unacceptable") to be stopped when goals are achieved or there are funding difficulties. Moreover, an withdraw of the subsidies may lead to further environmental harm since it would induce the adverse actions such as intensification and return to the conventional farming**.**

The main critics of the subsidies are associated with their "distortion effect", and the negative impact on "entry-exit decisions" from polluting industry, and the unfair advantages to certain sectors in the country or industries in other countries, and not considering the total costs (transportation and environmental costs, and "displacement effect" in other countries). It is estimated that the agri-environmental payments are efficient in maintaining the current level of environmental capital but less successful in enhancing the environmental quality (EC).

Often providing *public information, recommendations, training and education* to farmers, other agrarian and rural agents, and consumers are the most efficient form.

In some cases, a *pure public organization* (in-house production, public provision) will be the most effective as in the case of important agro-ecosystems[46] and national parks; agrarian research, education and extension; agro-meteorological forecasts; border and internal sanitary and veterinary control etc.

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[42] In Scandinavia the introduction of such tax brought about a reduce use of pesticide. In contrast, doubling the tax rate in California had no discernable effect on sales (ECOTEC).

[43] In EU, USA, and Japan the public environmental contracts are mostly with the individual farmers while Canada, Australia, and New Zealand direct support to community (collective) actions.

[44] Averaging 25% of the Utilized Agricultural Area (UAA) in old EU members (EC).

[45] A study in France shows that 40% of the farmers face some difficulties to enforce contracts in their parts of the environmental impact (Dupraz *et al.*).

[46] For instance, in Japan a special (so call "third sector") public organization at local level take care of farmland in unpopulated regions.

Usually, individual modes are effective if they are applied *alone with other modes* of public intervention. The necessity of *combined* intervention (a *governance mix)* is caused by: the complementarities (joint effect) of the individual forms; the restricted potential of some less expensive forms to achieve a certain (but not the entire) level of the socially preferred outcome; the possibility to get an extra benefits (e.g. "cross-compliance" requirement for participation in public support programs); the particularity of the problems to be tackled; the specific critical dimensions of the governed activity; the uncertainty (little knowledge, experience) associated with the likely impact of the new forms; the practical capability of the Government to organize (administrative potential to control, implement) and fund (direct national budget resources and/or international assistance) different modes; and not least important the dominating (right, left) policy doctrine (Bachev, 2007).

Besides, the *level* of an effective public intervention (governance) depends on the scale of the ecosystem and the kind of the problem. There are public involvements which are to be executed at *local* (individual ecosystem, community, regional) level, while others require a *nationwide* governance. And finally, there are activities, which are to be initiated and coordinated at *international* (regional, European, worldwide) level due to the strong necessity for *trans-border and multinational actions* (needs for a cooperation in natural resources and environment management, for prevention of ecosystem disturbances, for reaching minimum critical mass for a positive result, for exploration of economies of scale/scale, for governing of spill-overs)[47] or consistent (national, local) *government failures*. Very frequently the effective management of many agro-ecosystem problems (risks) requires *multilevel* governance with a system of combined actions at various levels involving diverse range of actors and geographical scales.

The public (regulatory, provision, inspecting etc.) modes must have built *special mechanisms* for increasing the *competency* (decrease bounded rationality and powerlessness) of the bureaucrats, beneficiaries, interests groups and public at large as well as restricting the possible *opportunism* (opportunity for cheating, interlinking, abuse of power, corruption) of the public officers and other stakeholders. That could be made by training, introducing new assessment and communication technologies, increasing transparency (e.g. independent assessment and audit), and involving experts, beneficiaries, and interests groups in the management of public modes at all levels. Furthermore, applying *"market like"* mechanisms, like open (including international) competition, auctions etc., in the public projects design, selection and implementation would significantly increase the incentives and decrease the overall costs.

Principally, a *pure* public organization should be used as a *last resort* when all other modes do not work effectively (Williamson). The "in-house" public organization has higher (direct and indirect) costs for setting up, running, controlling, reorganization, and liquidation. What is more, unlike the market and private forms there is *not an automatic mechanism* (such as competition) for sorting out the less effective modes[48]. Here a *public "decision making"* is required which is associated with high costs and time, and it is often influenced by the strong private interests (the power of lobbying groups, policy makers and their associates, employed bureaucrats) rather than the efficiency. Along with the development of the general *institutional environment* ("The Rule of Law") and the measurement, communication etc. *technologies,* the efficiency of pro-market modes (regulation, information, recommendation)

[47] e.g. in 2009 Bulgarian authority started fox vaccination as part of EU fox protection initiative.

[48] It is not rare to see highly inefficient but still very "sustainable" public organizations around the world.

and contract forms would get bigger advantages over the internal less flexible public arrangements (Bachev, 2007).

Usually *hybrid modes* (public-private partnership) are much more efficient than pure public forms given coordination, incentives, and control advantages. Involvement of farmers, beneficiaries and interest groups increases efficiency - decreases asymmetry of information, restricts opportunisms, increases incentives for private costs-sharing, and reduces management costs.

For instance, a hybrid mode would be appropriate for carrying out supply of environment, biodiversity, landscape, and heritage preservation service by farmers. That is determined by the farmers information superiority, the interlinks of activity with farming production (economy of scope), the high assets specificity to farm (farmers competence, investment's cite-specificity to farm, land, ecosystem), the spatial interdependency (needs for farmers cooperation at ecosystem or wider scale), and the origin of negative externalities. Furthermore, enforcement of most environmental, biodiversity etc. standards is often very difficult or impossible. In all these cases, stimulating and supporting (assisting, training, funding) private voluntary actions are much more effective then the mandatory public modes in terms of incentive, coordination, enforcement, and disputing costs (Bachev, 2004).

The comparative analysis let us *improve the design* of new forms of public intervention according to the *specific* natural, market, institutional *conditions* of a particular agro-ecosystem, region, country [49], and in terms of *perfection of the coordination, adaptation, information, stimulation, restriction of opportunism, controlling* (in short – minimization of transaction costs) of participating *actors* (decision-makers, implementers, beneficiaries, and interest groups).

It is essential to assess the *comparative* efficiency of *practically* (technically, socially) *possible* and *alternative* forms of public governance. Thus, the *additional benefits* (problems to be solved, risks to be overcome, new goals to be achieved), **and** the *costs,* **and** the *modes* for a new public intervention must be *socially admissible* (acceptable).

If different forms permit achieving the *same goals*, tackling the *same problems*, overcoming the *same risks* etc., the analysis is to focus on the selection of the mode *minimizing the total* (implementing *and* transacting) *costs.* Moreover, a form having the same (or less) costs as the alternatives is to be chosen if it provides *more benefits* or it is (socially, politically, technically) more *preferable* than other arrangements. If one of the possible forms provides *more benefits at the expense of more costs*, then the selection is to be made depending on whether the *additional costs* for that public intervention are *socially acceptable* (and feasible) or not. Similarly, if there is a *single* (only one) mode available for governing a particular intervention (achieving a certain sustainability goal) it would be introduced only if associated implementing *and* transacting costs are socially *admissible* (and feasible).

Our comparative analysis also unable us to *predict* likely cases of *new* public (local, national, international) *failures* due to the impossibility to mobilize sufficient political support and necessary resources and/or ineffective capability for implementation of otherwise "good" policies in the specific economic and institutional environment of a particular ecosystem, region, country etc. Since the public failure is a feasible option its timely *detection* permits foreseeing the persistence or rising of certain environmental problems and conflicts, and *informing* (local, international) community about associated risks[50].

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[49] Following North's remarks that effective institutions can rarely be "imported" but must be designed for the specific conditions of different ecosystems, communities, regions, countries .

[50] For instance, most countries have declared a "green recovery strategy" for overcoming the current financial and economic crisis. However, only few of them actually take the appropriate measures and put needed resources in than direction.

Part 2. Bulgarian Experience in Agro-ecosystem Services Governance

1. Modes and efficiency of environmental governance

The post-communist transformation and EU integration has been associated with significant *challenges* and *opportunities* for the agro-ecosystems and their services.

During most of the transition diverse environmental rights (on clean and athetie nature; preservation of natural resources, biodiversity) were not defined or were badly defined and enforced (Bachev, 2008). Furthermore, inefficient public enforcement of laws and contracts has been common during transition now. Besides, out-dated system of public regulations and control dominated until recently which corresponded little to the contemporary needs of environmental management. Besides, there was no modern system for monitoring the state of soil, water, and air quality, and credible information on the extent of environmental degradation was not available.

What is more, there existed no social awareness of the "concept" of environmental sustainability and ecosystem services nor any "needs" they to be included in public policy and/or private and community agenda. The lack of eco-culture and knowledge has also impeded the evolution of voluntary measures, and private and collective actions (institutions) for effective governance of ecosystem services.

In the last few years before EU accession, country's laws and standards were harmonized with the immense EU legislation. The Community Acquis have introduced a modern framework for the environmental governance including new rights (restrictions) on protection and improvement of environment, preservation of traditional varieties and breeds, biodiversity, animal welfare etc. What is more, EU accession established and enforces a *"new order"* - strict regulations and control; tough quality, food safety, environmental etc. standards; financial support etc. The external monitoring, pressure and likely sanctions by the EU improves the enforcement of laws and standards in the country.

Nevertheless, a good part of the new "rules of the game" are still not well-known or understood by the various public authorities, private organizations and individuals. Generally, there is not enough readiness for the effective implementation of the new public order because of the lack of experience in agents, adequate administrative capacity, and/or practical possibility for enforcement of novel norms (lack of comprehension, deficient court system, widespread corruption etc.).

In many instances, the enforcement of environmental standards is difficult (practically impossible) since the costs for detection and penalizing of offenders are very high, or there is no direct links between the performance and the environmental impact. For example, although the burning of (stubble) fields has been banned for many years yet this harmful for the environment practice is still widespread in the country. Subsequently, a permanent deterioration of soil quality[51], wasting the accumulated through photosynthesis soil energy, an extermination of soil micro flora and other habitats, a significant contribution to green-house emissions[52], multiplying instances of forests fires, diminishing visibility and increasing traffic accidents, all they come out as a result (EEA).

The harmonization with the EU legislation and the emergence of environmental organizations also generate new conflicts between private, collective and public interests.

[51] Losses reach up to 80% of the organic carbon and nitrogen, and up to 50% of the remaining main nutrition elements in the soil (EEA).

[52] According to estimates they account for 5793 tons methane, 1883 tons carbon oxide, 4344879 tons carbon dioxide, and 3621 tons nitrogen oxide in 2006 (EEA).

However, the results of the public choices have not always been for the advantage of the effective environmental management. For instance, the strong lobbying efforts and profit-making interests of particular individuals and groups have led to 20% reduction in numbers and 50% reduction in area of initially identified sites for the pan European network for preservation of wild flora, fauna and birds NATURA 2000.

During much of the transition newly evolving market and private structures have not been efficient in dealing with various environmental issues.

The privatization of agricultural land and other assets of ancient public farms took almost 10 years to complete. During a good part of that period, the governance of a farmland and other eco-resources was in ineffective and "temporary" structures (Privatization Boards, Liquidation Councils, Land Commissions). Sales and long-term lease markets for farmland did not emerge until 2000, and leasing on an annual base was a major form for the extension of farm size until recently. That was combined with a high economic and institutional uncertainty, and a big inter-dependency of agrarian assets (Bachev, 2006).

Consequently, most of the farming activities have been carried out in less efficient and unsustainable structures such as reorganizing public farms, part-time and subsistence farms, production cooperatives, and huge business farms based on provisional lease-in contracts (Table 1). Furthermore, market adjustment and intensifying competition has been associated with a significant decrease in number of unregistered farms (74%) and cooperatives (51%) since 1995.

Table 1: Number, size and importance of different type farms in Bulgaria

	Public farms	**Unregistered**	**Cooperatives**	**Agro-firms**	**Total**
Number of farms					
1989	2101	1600000	na	na	1602101
1995	1002	1772000	2623	2200	1777000
2000	232	755300	3125	2275	760700
2007		458617	1281	5186	465084
Share in number (%)					
1989	0.13	99.9			100
1995		99.7	0.1	0.1	100
2000		99.3	0.4	0.3	100
2007		98.6	0.3	1.1	100
Share in farmland (%)					
1989	89.9	10.1			100
1995	7.2	43.1	37.8	11.9	100
2000	1.7	19.4	60.6	18.4	100
2007		32.2	24.7	43.1	100
Average size (ha)					
1989	2423.1	0.4			3.6
1995	338.3	1.3	800	300	2.8
2000	357.7	0.9	709.9	296.7	4.7
2007		2.2	613.3	364.4	6.8

Source: National Statistical Institute, Ministry of Agriculture and Food

Post communist transformation has also seen a significant change in the governance of livestock activity. The specialized livestock farms comprise a tiny portion of all farms (Table 2) while 97% of the livestock holdings are miniature "unprofessional farms" breading 96% of the goats, 86% of the sheep, 78% of the cattle, and 60% of the pigs in the country (MAF).

Table 2: Number and size of livestock holdings in Bulgaria (2008)

Type of holdings	Share		Share		Share		Share		Average heads
	farms	heads	farms	heads	farms	heads	farms	heads	
	1-2		***3-9***		***10-19***		***20 and >***		
Dairy cows	79.8	36.1	16	25.2	2.5	11.8	1.6	26.8	2.7
	1-9		***10-49***		***50 -99***		***100 and >***		
Ewes	85	37.1	12	24.5	2	15	1	23.4	8.6
She-goats	97.1	75.3	2.7	17.4	0.2	4.1	0.1	3.2	2.8
	1-2		***3-9***		***10-199***		***200 and >***		
Breeding pigs	78.8	12.8	14.9	8.8	5.8	21.1	0.5	57.4	7.8

Source: MAF Agro-statistics

Dominating modes for carrying out farming activities have had little incentives for long-term investment to enhance environmental performance (Bachev, 2008). The cooperative's big membership makes individual and collective control on management very difficult. That focuses managerial efforts on current indicators, and gives a great possibility for using coops in the best private interests. Besides, there are differences in the investment preferences of diverse coops members due to the non-tradable nature of the cooperative shares. Given the fact that most members are small shareholders, older in age, and non-permanent employees, the incentives for long-term investment for land improvement, and renovation of material and biological assets have been very low. Last but not least important, the "member-oriented" and non-for-profit nature of cooperatives prevents them to adapt to diversified needs of members, and market demand and competition.

On the other hand, small-scale and subsistent farms[53] possess insignificant internal capacity for investment, and small potential to explore economy of scale and scope (big fragmentation and inadequate scale). Besides, they have little incentives for non-productive (environment conservation, animal welfare etc.) investment. Small-scale producers and most livestock farms are having a hard time adapting to new competition pressure, investment needs, and new food safety, environmental, animal-welfare etc. standards[54]. Moreover, there has been no state administrative capacity nor a political will to enforce the quality and eco-standards in that vast informal sector of the economy.

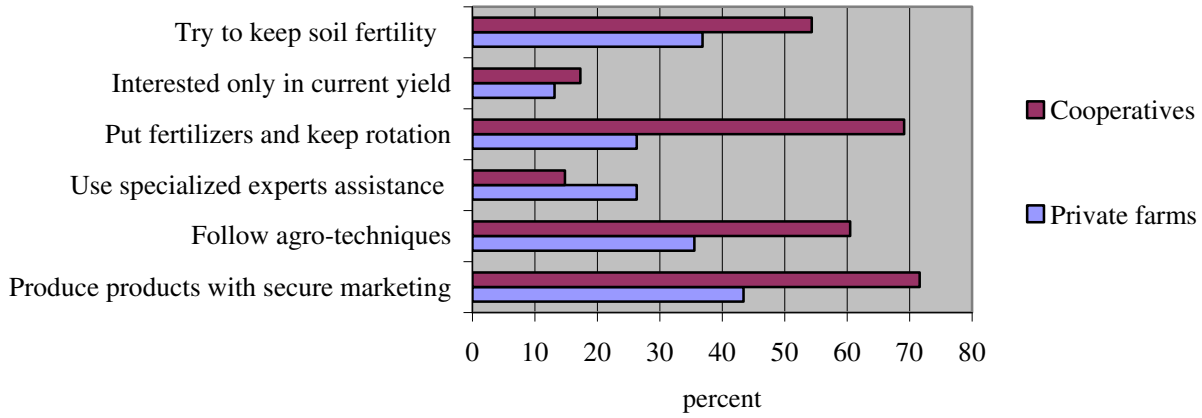
Likewise, the larger business farms operate mainly on leased land and concentrate on high pay-off investment with a short pay-back period (cereals, sunflower). That has been coupled with ineffective outside pressure (by authority, community) for respecting the official standards for ecology, land use (crop rotation, nutrition compensation), biodiversity etc.

In general, survivor tactics ("concentration on products with secure marketing") rather than a long-term strategy toward farm sustainability has been common among the commercial farms (Figure 6). At the same time, a good portion of coops and most part of non-cooperative farms do not implement strategies for keeping ecological sustainability (preserving soil fertility, observing crop rotation and agro-techniques requirements etc.).

Figure 6: Share of Bulgarian farms implementing different production strategies (%)

[53] Subsistence and semi-market farms comprise the best part of the farms as almost 1 million Bulgarians are involved in farming on a part-time base and for "supplementary" income (MAF).

[54] Diary farming is particularly vulnerable, since, only 1,4% of the holdings with 17% of the cows in the country meet EU quality, hygiene, veterinary and building standards (MAF)



Source: Survey data

During the entire transition the agrarian long-term credit market was practically blocked while newly evolving farming left unassisted by the government[55]. Despite the considerable progress in public support in recent years (EU Special Assistance Program for Agriculture and Rural Development – SAPARD, CAP measures) the overall support to agriculture rests very little (Table 3). Currently, only a small proportion of the farms benefits from some form of public aid most of them being large enterprises from regions with less socio-economic and environmental problems [56].

Table 3: Share of EU and national support in Net Income of different Bulgarian farms in 2008 (percent)

Type of farm	Share of subsidies in farms Net Income	
	Current subsidies	***Investment subsidies***
Field crops	63.2	2.1
Horticulture	1.3	1.8
Permanent crops	0.4	2.2
Livestock	0.3	0

Source: MAF Agro-statistics

EU accession has also brought new opportunities to get public support for divers private and collective activities related to agro-ecosystem services. For instance 2007-2013 National Plan for Agricultural and Rural Development (NPARD) provides significant funding for area-based and agro-environmental payments (organic farming, management of agricultural lands with high natural value, traditional livestock, protection of soils and water, and preservation of landshaft features[57]); modernization of farms, processing and marketing; diversification of

[55] The Aggregate Level of Support to Agriculture before 2000 was very low, close to zero or even negative (OECD, 2000).

[56] In 2008 less than 16% of all farms got EU Area Based Payments and 13% of the farms received national top-ups (typically the same farms touch both type payments). SAPARD measure "Agro-ecology" was not approved until September 2006 and few projects were actually funded. In 2008 there are only 27079 approved projects supporting farms from "unfavarable" regioms (MAF).

[57] *special environmental measures* (going beyond the "good farming practices") represent 27,1% of the total funding in NPARD and provide support for 5 year eco-contracts.

activity; infrastructural development; keeping traditions; training etc. Moreover, requirement for "cross-compliance" (with modern quality, safety, environmental, animal welfare etc. standards[58]) for receiving public support is introduced. Funding for projects related to eco-system services is also available from Fund LIFE+ and Operational Programs "Environment", "Fishery and Aquaculture" and "Regional Development".

Similarly to the past, mostly bigger farms participate in rural development programs because they have a superior entrepreneurial experience, available resources, capability for adaptation to requirements and for wining projects. Besides, it has been impossible to reform the inefficient system of management of public programs. Consequently, a significant EU funding has been blocked by European Commission in 2008 while SAPARD and other support irreversibly lost. As a result of the minor amount of supported farms (and agro-ecosystems), and the deficiency of clear criteria for eco-performance, and the lack of effective control, various public programs have contributed barely to overall improvement of environmental situation.

Market governance has led to a sharp decline in all crop (but sunflower) and livestock (but goat) productions comparing to 1989 level[59]. The smaller size and owner operating nature of the majority of farms avoided certain problems of the large public enterprises from the past such as lost natural landscape, biodiversity, nitrate and pesticide contamination, huge manure concentration, uncontrolled erosion etc. Subsistent and small-scale farming has also revived some traditional (and more sustainable) technologies, varieties and products.

In addition, the private mode has introduced incentives and possibilities for an integral environmental management (including revival of eco- and cultural heritage, anti-pollution, esthetic, comfort etc. measures) profiting from the inter-dependent activities such as farming, fishing, agro-tourism and recreation, processing, trade etc. Last but not least, there are good examples for foreign direct investment in cereals, oil crops, and integrated with farming vine and food processing, which introduce modern (western) governance, technologies, quality, and environmental standards.

A by-product from dominating "market and private governance" has been a considerable desintensification of agriculture, and an ease of the general environmental pressure and pollution comparing to the pre-reform level. For instance, the total amount of used chemical fertilizers and pesticides has declined considerably, and now their per hectare application represent merely 22% and 31% of 1989 level (MAF). That sharp reduction in chemical use has diminished drastically the risk of chemical contamination of soils, waters, and farm produce. Consequently, a good part of the farm production has got unintended "organic" character obtaining a good reputation for products with a high quality and safety.

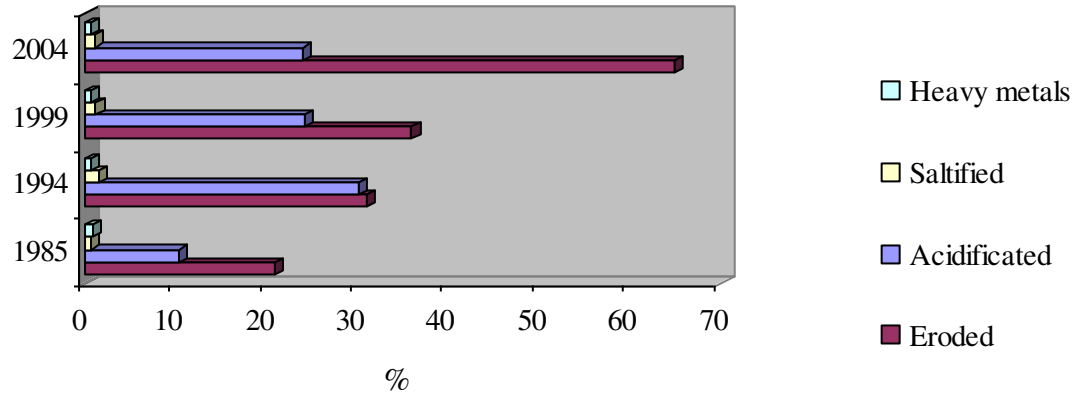
Nonetheless, a negative rate of fertilizer compensation of N, P and K intakes dominate being particularly low for phosphorus and potassium[60]. Accordingly, an average of 23595,4 t N, 61033,3 t P_20_5 and 184392 t K_20 have been irreversibly removed annually from soils since 1990 (MAF). Furthermore, an unbalance of nutrient components has been typical with application of 5,3 times less phosphorus and 6,7 times less potassium with the appropriate rate for the nitrogen used during that period. Moreover, a monoculture or simple rotation has

[58] For receiving direct payments land must be kept in "good agronomic and ecological condition".
[59] For potatoes by 33%, wheat 50%, corn and burley 60%, tomatoes, Alfalfa hay and table grape 75%, apples 94%, pig meat 82%, cattle meat 77%, sheep and goat meat 72%, poultry meat 51%, cow milk 45%, sheep milk 66%, buffalo milk 59%, wool 85%, eggs 45%, honey 57% (NSI).
[60] For N 78%, for P 25% and for K 1.5% (MAF).

been constantly practiced by most large operators concentrating on few profitable crops (such as sunflower and wheat). All these practices further contributed to deterioration of soil quality and soil organic matter content.

There has been also a considerable increase in agricultural land affected by acidification (Figure 7). It has been a result of a long-term application of specific nitrate fertilizers and unbalanced fertilizer application without adequate input of phosphorus and potassium. Currently almost a quarter of soils are acidified as percentage of degraded farmland acidified soils reach 4,5% of total lands. During the entire period no effective measures have been taken to normalize soil acidity and salinity.

Figure 7: Share of degradated agricultural lands in Bulgaria



Source: Executive Environment Agency

Erosion has been another major factor for land degradation (Figure 7). Due to ineffective management around one-third of the arable lands are subjected to wind erosion and 70% to water erosion as total losses varies from 0,2 to 40 t/ha in different years. The progressing level of erosion has been adversely affected by dominant agro-techniques, deficiency of anti-erosion measures, and uncontrolled deforestation (EEA).

There has been also a sharp reduction of irrigated farmland since 1990 as merely 2-5% of existing irrigation network has been practically used. Consequently, irrigation impact on erosion and salinization has been significantly diminished. However, the decline in irrigation has had a direct negative effect on crop yields and structure of crop rotation. In addition, irrigation has not been effectively used to counterbalance the adverse effect of global worming on farming (extension of farm season, increased water requirements, fall of rainfalls) and further degradation of agricultural land.

There has been a significant reduction of overall green-house gas (GHG) emissions in general and from agriculture in particular[61]. The N_2O emissions comprise 59% of the total emissions from agriculture as sector is the major ammonia source accounting for two-third of the national (Vassilev *et al.).* The majority of NO_2 emissions come from agricultural soils (87%), manure management and burning of stubble fields (13%). The methane emission from agriculture represents about a quarter of the national. The biggest portion of CH_4 comes from fermentation from domestic livestock (72%) and manure management (24%).

The new private management has been often associated with less concern to the manure and garbage management, over-exploitation of leased and common resources, and

[61] In recent years agricultural GHG comprises 33% of its 1988 level (Vassilev *et al.)*

contamination of air and groundwater. For instance, the illegal garbage yards in rural areas have noticeably increased[62]. Farms contribute extensively to waste "production" with both organic and industrial materials, leading not only to negative changes in the beauty of scenery but also bring about air, soil and water pollution. Pollution of soil and water from industrial activities, waste management, and improper farming activities still presents risk for the environment and human health. Data shows that in 7% of the tested soils, concentration of pollutants is higher than the contamination critical limits (EEA).

Furthermore, around a quarter of the riverlength does not meet the normal standards for good water quality (MAF). Monitoring of water for irrigation shows that in 45% of water samples, the nitrates concentration exceeds the contamination limit value by 2 to 20 folds (MAF). Nitrates are also the most common polluter of underground water[63] with a slight excess over the ecological limit in recent years (EEA). The lack of effective manure storage capacities and sewer systems in majority of farms contribute significantly to the persistence of the problem. A major part of the livestock activity is carried out by a great number of small and primitive holdings often located within village and town borders. Merely 0,1% of the livestock farms possess safe manure-pile sites, around 81% of them use primitive dunghills, and 116 thousands holdings have no facilities at all (MAF). All that contributes significantly to pollution of air, water and soils, and disturbing population comfort (unpleasant noise and odor, dirty roads etc.).

There have been also significant degrading impacts of agriculture on biodiversity. According to the official data all 37 typical animal breeds have been endangered during the last several decades as 6 among them are irreversibly extinct, 12 are almost extinct, 16 are endangered and 3 are potentially endangered (MEW).

Since 1990 a considerable portion of agricultural lands have been left uncultivated for a long period of time or entirely abandoned[64]. Consequently, a significant part of agro-ecosystem lost their "agro" character turning into natural ecosystems. That has caused uncontrolled "development" of species allowing development of some of them and suppressing others. Besides, some of the most valuable ecosystems (such as permanent natural and semi-natural grassland) have been severely damaged[65]. Part of the meadows has been left under-grazed or under mowed, and intrusion of shrubs and trees into the grassland took places. Some of fertile semi-natural grasslands have been converted to cultivation of crops, vineyards or orchards. This has resulted in irreversible disappearance of plant species diversity. Meanwhile, certain public (municipal, state) pastures have been degraded by the unsustainable use (over-grazing) by private and domestic animals. In addition, a reckless collection of some valuable wild plants (berries, herbs, flowers) and animals (snail, snakes, fish) have led to destruction of all natural habitats.

A market driven organic farming has emerged in recent years. It is a fast growing approach but it is restricted to 432 farms, processors and traders, and covers less than 3% of the Utilized Agricultural Area (MAF). There are only few livestock farms and apiaries certified for bio-production. In addition, 242677 ha have been approved for gathering wild organic fruits and herbs.

The organic form has been introduced by business entrepreneurs who managed to organize and fund this new venture arranging needed independent certification[66] and finding

[62] Official figure for major illegal garbage locations is 4000 (EEA) while actual figure is far bigger.
[63] Nitrate Vulnerable Zones cover 60% of country's territory and less than 7% of agricultural land use.
[64] Currently, almost 10% of all agricultural lands is unutilized farmland. In addition, fallow land accounts for 9,5% of the arable land (MAF).
[65] Approximately 20% of the agricultural lands of Bulgaria are lands of High Nature Value (MAF).
[66] A good part of the certification has been done by foreign bodies since until recently no Bulgarian certification institutions existed or recognized in other countries (like USA).

potential buyers for the highly specific output. Produced bio fruits, vegetables, essential oil plants, herbs, spices, and honey are entirely for export since only a tiny internal market for organic products exists in the country.

The slow development of organic market is not only because of the higher prices of organic products but also because of the limited consumer confidence in the authentic character of products and certification[67]. In addition, eco-labeling of processed farm products (relying on self-regulation) have appeared which is perceived more a part of the marketing strategy of certain companies rather than a genuine action for environmental improvement.

The evolution of farmers and environmental associations has been hampered by the big number of agrarian and rural agents and their diversified interests - different size of ownership and operation, type of farming, individual preferences, different age and horizon etc. (Bachev, 2009). Even nowadays, there are few examples for effective organizations predominately with small membership and strong common interests of participants.

The Government and local authority involvement in eco-governance has not been significant, comprehensive, sustainable, or even related to the matter (Bachev, 2008). The total budget of the Ministry of Water and Environment accounts for just 1,5% of the National Budget, and the agricultural sector gets a tiny portion of all public eco-spending (MWE). Similarly, recultivation of degradated farmlands by the MAF has been under way recently but it accounts for merely 200-250 ha per year (MAF).

In the passed several years a number of national programs have been developed to deal with the specific environmental challenges like: preservation of biodiversity and environment; limitation of emissions of Sulphur Dioxide, VOC, and Ammonia; waste management; development of water sector; combating climate change; developing organic agriculture; management of lands and fights against desertification; agrarian and rural development etc.

In addition, national monitoring systems of environment and biodiversity have been set up and a mandatory ecological assessment of public programs introduced. Nevertheless, the actual eco-policies rest fragmented and largely reactive to urgent environmental problems (natural disasters such floods, storms, drought) rather that based on a long-term strategy for sustainable development. There have been numerous international (UN, EU, NGO, etc.) assistance projects to “fill the gap” in local failures but they are limited in scale and unsustainable in time; in some cases overtaken by the local groups and funding improperly used; and above all with no significant impact (Bachev, 2008). Finally, National Agricultural Advisory Service does not serve the majority of farms and include rural development and environmental issues.

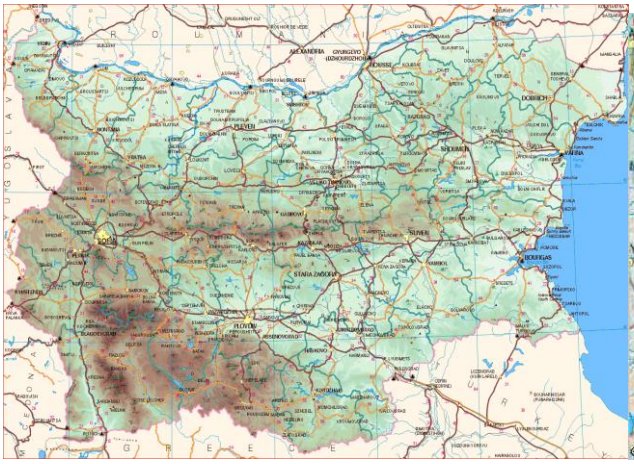
As a result of inefficient priority setting and management (lack of coordination, incompetence, corruption), and insufficient administrative capacity a minor impact of the public programs prevails (Bachev, 2008). For instance, a serious environmental challenge is still caused by the state deficiency in storing and disposal of the out-of-dated pesticides of the ancient public farms[68]. What is more, as much as 82% of all polluted localities in the country are associated with these dangerous chemicals.

[67] Fake labeling of organic and original products are reported daily by the Organization for Consumer Protection.

[68] They account for 11079 t and stored in 460 locations just 38% of them being guarded (EEA).

2. The case of Zapadna Stara Planina

We have surveyed structure, efficiency and prospects of governance of agro-ecosystem services in Zapadna Stara Planina (ZSP) – a mountainous region in North-West Bulgaria (Map 1 and Map 2). The specific agro-ecosystems services and their governance are significantly affected by the post-communist transformation. The evolution and challenges of the eco-governance in ZSP give also good insights on the state of agro-ecosystem services in other mountainous regions of the country.



Map 1: Map of Bulgaria

Map 2: Zapadna Stara Planina ecosystem

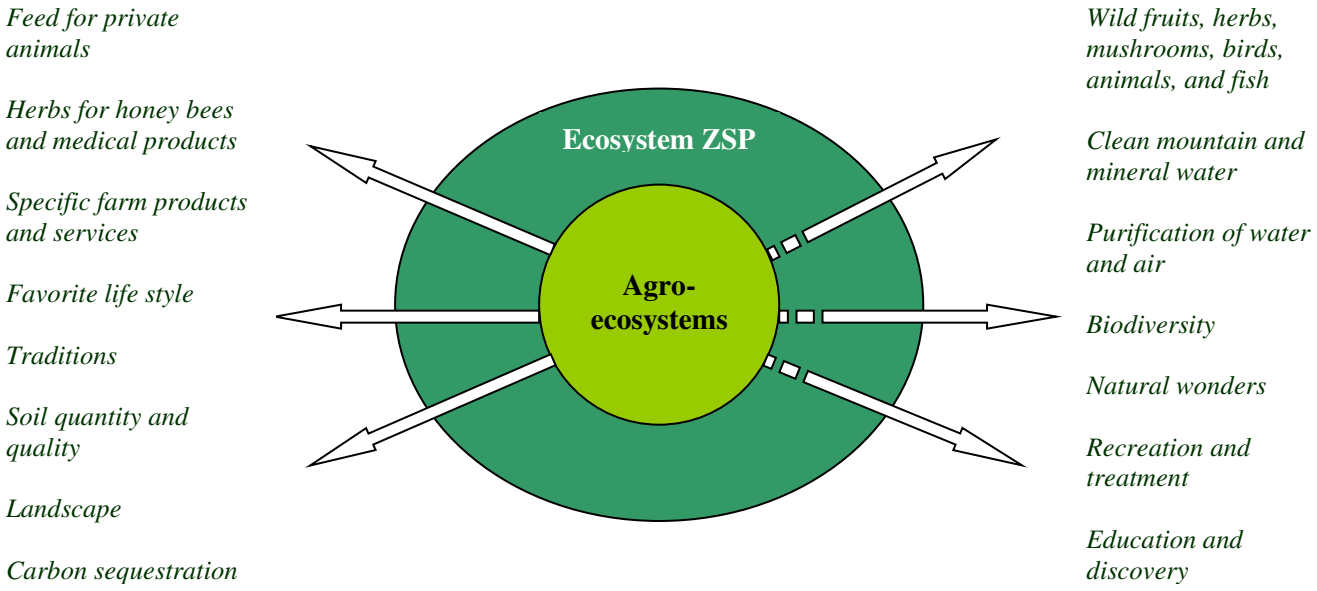
Agro-ecosystems in ZSP are part of the unique ecosystem of ZSP. ZSP region covers area of 4043 km_2 (2099 km_2 in Bulgaria and 1944 km_2 in Serbia) out of which 60% is forests and the rest is farmland (Grigorova and Kazakova). Bulgarian portion of ZSP accounts for 3,6% of the territory of the country while its agro-ecosystems comprise less than 2,8% of the national total[69].

Agro-ecosystems in ZSP provide a wide range of *specific* services (Figure 8). A great number of agents *from* and *outside* region *benefit from* and *affect* services of these ago-ecosystems – natural resources owners[70], farmers, residents, businesses, visitors, consumers, scientists, interest groups etc.

[69] Agricultural land in Bulgaria is 5710 thousand ha accounting for 51.4% of the territory of the country (NSI).

[70] 50% of the pollution in ZSP own agricultural lands (Grigorova and Kazakova).

Figure 8: Services of Agro-ecosystems in Zapadna Stara Planina



Approximately 70% of the farmland in ZSP comprises meadows and pastures (MAF). They provide abandon feed for farm and household animals, and create good conditions for development of grazing livestock (sheep, goats, cattle, buffalos, horses) and domestic animals (poultry, rabbits, pigs). In addition, there are plenty of wild flowers and herbs which favor bees keeping and herbal honey production as well as collection of natural medical plants.

Furthermore, a wide range of farm products are produced in this environment used for provisioning of local population and marketing. Some of the local farm-based produces are well-known for their quality, unique taste and original character (strawberry, raspberry, blackberry, berry jams, herb honey, sheep yogurt and cheese, lamb meat, wool, fur, prune, plum brandy) and marketed at regional, national and international markets. Simultaneously, they favor development of related productions and services being important income source for local populations – (jam, dairy, brandy, leather) processing, dying wool, weaving and crafts making, on-farm and direct marketing, agro- and rural tourism.

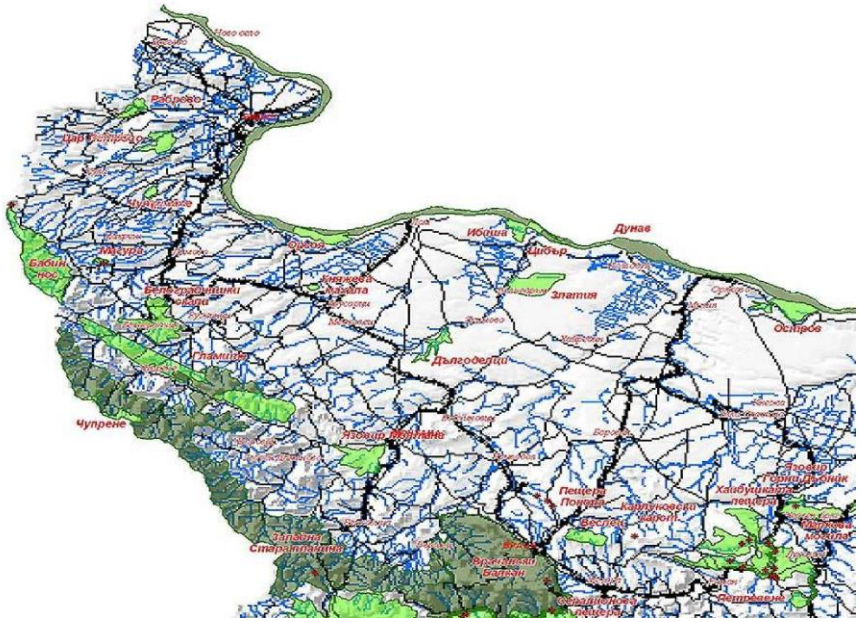
What is more, for many local and not-permanent residents interactions with agro-ecosystems are favorite mode of recreation (part-time or hobby farming, short or longer term visits) or life style (weekend and summer houses). Moreover, local traditions and ethnic culture of *Torlaks* and *Karakachans* are closely related to agro-ecosystems and farming system – specific agricultural and related products (e.g. Chiprovtsi hand-made carpets), crop verities and animal breeds, production methods and technologies, festivals, cuisine, crafts etc. Besides, unique shape and quality of landscape is a critical feature of agro-ecosystems dominating by natural or semi-natural high mountain pastures, riparian meadows, stony and rocky terrains. All these attract many visitors from the region, country and abroad.

Next, agro-ecosystems contribute significantly for maintaining (improving) soil quality - vegetation cover reducing soil loss and degradation and promoting water infiltration. Furthermore, carbon sequestration is important service of grasslands, berry bushes, orchards and vineyards storing considerable amount of CO_2 stock.

Agro-ecosystems also provide *combined* services with the larger ecosystem of ZSP. A great variety of wild fruits, herbs, chestnuts, mushrooms, birds, animals and fish are available and picked up or hunted by local population and visitors. What is more, some of them are commercially gathered for processing and sells bringing additional incomes for around 20% of population (Grigorova and Kazakova).

Ecosystem ZSP is a source of clean mountain and mineral water used by farmers (for animals, irrigation), residents (for drinking, household needs), businesses (for inputs, bottling) and health centers (for balneotherapy) in the region and neighboring areas. Besides, it purifies water and air and regulate climate making region one of the favorite destination for tourism, recreation and treatment. Well-known mountainous resorts like Berkovitza, Varshetz, and Izketz are located in ZSP. Moreover, some of the country's most popular natural wonders like Rocks of Belogradchik[71], Iskar Gorge, and number of picks, waterfalls and caves are situated in ZSP enhancing cultural services of the ecosystem.

Furthermore, territory of ZSP is with high ornithological and botanical importance designated as Pan-European network NATURA 2000 site (Map 3). Maintaining this rich biodiversity is a great service of the ecosystem ZSP. For instance, in its flora there are more than 2000 species of higher plants (among which 12 Bulgarian and 79 Balkan endemics[72]) while its fauna comprise more than 180 bird species, more than 50 species of mammals, 26 species of amphibians and reptiles, and many butterfly species of conservation importance (Grigorova and Kazakova). All these increase educational and scientific services of this unique ecosystem as well.



Map 3: Natura 2000 Habitat directive sites (light green) and Bird directive sites (dark green)

[71] It is nominated to be one of New 7 Natural Wonders of the World.

[72] Besides, hill "Vrashka Chuka" is worlds only place of *Eranthis bulgaricus*.

Various market, private and public modes are used for governing the agro-ecosystem services in ZSP (Figure 9).

Figure 9: Modes of governance of agro-ecosystem services in Zapadna Stara Planina

Market	Private	Public
Informal branding *Organic (berry) farming* *Organic apiaries* *Organic livestock* *Organic wild fruits and herbs gathering* *Specific origins (lamb, cheese, berries, carpets, crafts)* *Organic processing (berries, milk, herbs)* *Eco-labeling* *On farm and direct marketing* *Clientatlisation (cheese, meat, berries)* *Agro and eco-tourism*	*Voluntary initiatives* *Long-term supply contracts (milk, berries)* *Vertical integration of farming into processing, services and marketing (shops, hotels, restaurants, export)* *Interlink organization (dairy)* *Diversification of production and services* *Cooperatives* *NGO's* *Organic alliances*	*Environmental regulations* *Eco-information, monitoring, assessment* *Promotion or joining eco-initiatives (festivals, networks, ads)* *Designated zones of eco-importance (natural parks, NATURA)* *Area-based direct payments* *Leasing out public land for private management* *Cross-compliance requirement* *Agro-ecological payments (voluntary contracts)* *Support to traditional and original productions* *Support to farms and processing modernization* *Support for semi-market farms* *Support to young farmers* *Support for adaptation of quality, safety, eco etc. standards* *Support to collective actions (producers groups, cooperation)* *Support for diversification of activity (eco-tourism, heritage)* *(Mandatory) environmental training* *Program for development of agriculture in North-West Bulgaria* *Fox vaccination* *Recultivation of degradated farmlands* *Garbage taxation* *State company for Vratza Natural Park* *Support to trans-border initiatives*

Post-communist reforms transferred the entire agrarian and agro-ecosystem services related activity from the large public farms into market and private governance. Private management and market adjustments have been associated with domination of small-scale and subsistence holdings (Table 4), and a sharp decline in crop and livestock productions, and general desintensification of activity. Private ownership introduced better incentives for environmental stewardship while small operational size led overcoming eco-problems of large public enterprises from the past. Besides, it revived some traditional and more sustainable technologies, varieties and products.

Table 4: Major characteristics of farms in Zapadna Stara Planina*

Indicator	Value	Indicator	Value
Number of farms	12151	Share of farms with cattle (%)	17,2
Average UAA (ha)	*0,997*	*Average cattle per farm*	*2,9*
Share of arable land (%)	33,6	Share of farms with sheep (%)	51,1
Share of cereals (%)	18,4	*Average sheep per farm*	*5,5*
Share of horticulture (%)	4,3	Share of farms with goats (%)	62,7
Share of grassland (%)	58,7	*Average goats per farm*	*2,6*
Share of permanent crops (%)	4,9	Share of farms with pigs (%)	47,2
Share of farms with bees (%)	6,3	*Average pigs per farm*	*1,5*
Average bees colonies per farm	*7,1*	Share of farms with poultry (%)	69,0
		Average poultry per farm	*14,2*

** Berkovitsa, Varshets, Georgi Damyanovo, Chiprovtsi, Belogradchik, Chuprene, Godech, Svoge municipalities*

Source: MAF, 2005

A positive result of the market and private governance has been the overall improvement of agro-ecosystems services in ZSP. Farm and related productions have got "organic" character obtaining good reputation for products with high quality and safety. The region has become attractive destination for many local and foreign tourists willing to experience genuine nature, traditional cuisine and lifestyle, or buy authentic farm products.

Market-driven formally certified organic production has also emerged in recent years but it is restricted to few farms, processors and traders. In fact, country biggest producers of organic raspberries and bee honey are located in ZSP. What is more, informal branding of fresh and processed farm (eco, origin, quality, low costs) produces has been increasing all the time and marketed though farmers and street markets or clientalisation between individual sellers and buyers (on farm sells, home delivery etc.).

A number of effective private modes have also evolved and govern relations between farmers, processors, food stores, and consumers. High specificity and capacity dependency are widely safeguarded by cooperation (services, processing), long-term contracts (marketing of milk and organic berries), interlinked organization (milk marketing against free provision of cooling vanes and credit), and compete integration (diversification of farming into processing, agro-tourism). Often non-agrarian agent (processor, food store, restaurant chain, exporter) driven by market or institutional demand initiates, funds, and integrates eco-farming. That is the case with Danon baying milk from big dairy farms (and enforcing safety, quality, environmental and animal welfare standards), a Japanese investors financing organic apiaries and exporting bio-honey, a leading restaurant chain in Sofia integrating dairy farming and processing.

Furthermore, there are a number of cases of informal small–scale (milk, meat) processing and marketing enterprise developed for petit producers aiming to overcome missing market and monopoly situation, and (more recently) significant institutional (e.g. milk and meat safety and hygiene standards, quotas) restrictions. Output is mostly for households consumption or marketed though informal channels (direct delivery).

Agricultural and general cooperatives have been typical mode having a great potential to organize highly specific to members transactions (supply of critical inputs and services, processing, marketing), explore economies of scale and scope, manage common resources, diversify in new businesses (like eco-truism), mediate relations between landowners and users, and adapt to requirements of banks and public institutions.

Market and private voluntary, and non-for profit or for-profit forms contribute significantly to improvement of eco-governance but their scope is usually restricted to portion of agro-ecosystems (services). For instance, a fifth of agricultural lands have been abandoned which caused expansion of some species and suppressing others. Furthermore, part of the permanent natural and semi-natural meadows have been left under-grazed or under-mowed, and intrusion of shrubs and trees into grassland took places putting pressure on priority species (like *Souslik*) and related chain (*Marbled Polecat*) (Grigorova and Kazakova).

Some of the fertile semi-natural grasslands have been converted to cultivation (crops, berries, vineyards, orchards) which caused irreversible disappearance of plant species diversity. Meanwhile, communal and private pastures close to settlements have been degraded by unsustainable use (over-grazing). In addition, uncontrolled collection of wild plants (berries, herbs, flowers) and animals (snail, snakes) have jeopardized natural habitats.

Besides, erosion has been major factor for land degradation as a result of land abandonment, inappropriate agro-techniques, deficiency of anti-erosion measures, and uncontrolled deforestation. In addition, lack of effective manure storage capacities in most

farms and modern sewer and garbage collection systems in rural areas bring about air, soil and water pollution, and affect beauty of the scenery.

What is more, a great number of smaller commercial farms and agricultural cooperatives have ceased to exist due to inefficient management, low adaptability to market competition, aging population, and labor exodus from the region. Similarly, majority of dairy farms and processors have failed to adapt to tough EU (safety, hygiene, environment, animal welfare) standard and had to stop commercial activity. Finally, private interests of particular individuals (groups) have harmed legitimate public rights to ecosystem services due to restricting access, conversion of proper use (conversion of farmland and forest into construction), or escaping public order on natural resource management.

Furthermore, due to restricting criteria[73], complicated procedures, bad design, and high transacting costs, the majority of farms (small-scale and subsistent holdings) have not been able to participate in diverse public support schemes. For example, less than 5% of all farms from ZSP, comprising 18% of grasslands and 8% of arable land, are registered in Land Parcels Identification System (indicating land eligible for CAP support). From SAPARD agro-ecological measures benefited less than 100 farms from ZSP while other supports went predominately to large farms and most developed regions (MAF). Similarly, due to limiting program requirements and insufficient funding merely few farmers got support under measure "Young farmers". At the same time, insufficient "demand" has been responsible for the few applications and the low utilization of funds for support of "Semi-market farms" and "Organizations of producers".

Introduction and enforcement of most environmental and biodiversity standards is difficult in remote mountainous region like ZSP with insufficient administrative, financial and training capacities. What is more, often costs for detection of offenders are extremely high and formal enforcement unproductive. For instance, prohibited marketing of fresh milk, and uncertified cheese and meat is common; fake labeling and certification is widespread; forbidden fields burning is practiced; the minimum-maximum numbers of animals on pastures and milk quotas are not respected; illegal lodging is common etc.

[73] For direct and agro-ecological payments minimum farm size is 1 ha (permanent crops 0,5 ha) and 0,5 ha as 0,1 ha parcel size also applies (landless livestock holdings are not eligible). NPARD does not provide support for restoration of abandoned farmland and organic livestock (but forage) production.

3. Prospects of eco-governance

The EU integration and CAP implementation provides new opportunities for Bulgarian farms. The *EU funding* alone, which agriculture receives from 2007 on is 5,1 times higher than the overall level of support to farming before acceding. What is more, huge *EU markets* are opened which will enhance competition and let local farms explore their comparative advantages (low costs; high quality, specificity and purity of produce). The novel conditions of market competition and institutional restrictions also give strong incentives (pressure) for new investments for increasing productivity and conforming to higher product, technology and environmental standards.

The larger and business farms are most sensitive to new market demand and institutional regulations since they largely benefit (or lose) from timely adaptation to new environmental regulations. Besides they have higher capacity to generate resources and find outside (credit, equity, public) funding to increase competitiveness and meet new institutional requirements. The process of adaptation is associated with appropriate land management and the intensification of production. The later could revive or deepen some of the environmental problems (erosion, acidification, pollution) unless pro-environmental governance (public order, effective enforcement) is put in place to prevent that from occurring.

On the other hand, small-scale producers and most livestock farms are having a hard time adapting to new competition pressure, investment needs, and new food safety, environmental, animal-welfare etc. standards. Significant EU funds for rural development would let more and relatively smaller farms to get access to public support scheme and invest in modernization of enterprises. Furthermore, new essential activities will be are effectively funded allowing diversification and pro-environmental activity. All these would help bringing additional employment and income increasing economic and environmental sustainability of farms.

Nevertheless, mostly bigger farms will participate in public support programs and get the bulk of the public support because of their superior entrepreneurial capability, resources, possibilities for adaptation, and potential for wining projects. Therefore, agrarian and rural development funds will probably continue to benefit exclusively the largest structures and the more developed regions of the country; and CAP support will not contribute to decreasing economic and eco-discrepancy between different farms, sub-sectors, and regions.

The CAP implementation will improve the environmental performance of commercial farms. There is a mandatory eco-conditionality for receiving direct payments and participating in other public programs. Moreover, direct payments will induce farming on previously abandoned lands, and improve environmental situation and biodiversity. Besides, there is a huge budget allocated for special environmental measures. Therefore, a number of farms taking part in various agri-environmental programs will gradually increase in future.

The CAP measures would affect positively the environmental performance of large business farms and cooperatives. Namely these enterprises (and potential big polluters) are under constant administrative control and severe punishment (fines, losing licenses, and ceasing activities) for obeying new environment, biodiversity, and animal welfare standards. Therefore, they are strongly interested in transforming their activities according to the new eco-norms making necessary eco-investments, changing production structures etc. Moreover, larger producers are motivated to participate in special agro-environmental and biodiversity programs, since they have lower costs (exploring economies of scale and scope) and higher benefits from such long-term public contracts.

The experience of other EU countries demonstrates that some terms of the specific eco-contracts are very difficult to enforce and dispute. In Bulgaria the rate of compliance with these standards would be even lower because of the lack of readiness and awareness,

insufficient control, ineffective court system, domination of "personal" relations and bribes etc. Correspondingly, more farms than otherwise would enroll will participate in such schemes (including the biggest polluters and offenders). Subsequently, the outcome of implementation of that sort of instruments would be less than the desirable (namely "European") level.

More to the point, direct costs and lost income for conforming to the requirements of the special programs in different farms vary considerably, and they have unequal incentives to participate. Having in mind the voluntary character of the most CAP support instruments, we should expect that the biggest producers of negative impacts (large polluters and non-compliant with modern quality, agronomic, biodiversity, animal welfare etc. standards) would stay outside of these schemes since they have the highest environment enhancement costs.

On the other hand, small contributors would like to join since they do not command great efforts (and additional costs) comparing to the supplementary net benefit. Moreover, the Government is less likely to set up high performance standards because of the perceived "insignificant" environmental challenges, the strong internal political pressure from farmers, and the possible external problems with the EU control (and sanctions) on cross-compliance. Therefore, CAP implementation will probably have a modest positive impact on the environment performance of Bulgarian farms.

The public support and new public demand will give a push to further development of market modes such as organic farming, industry driven eco-initiatives (eco-labeling, standards, professional codes of behavior), protected high quality products, system of fair-trade, production of alternative (wind, manure) energy at farm etc. For instance, the significant EU market and lower local costs create strong incentives for investment in organic and specific productions by the large enterprises - farms, partnerships and joint ventures (including with non-agrarian and foreign participants). Similarly, new incentives for production of bio-fuel and clean energy would induce development of a new area of farm activity (new sub-sectors) associated with that new public and market demand.

Principally, the small farms have less capacity to put together or find necessary capital and expertise for initiating, developing, certifying and marketing in all these new venture. Besides, the coalition (development, management, and exit) costs between small-scale producers are extremely high to reach the effective operation level (allowing exploring technological economies of scale and scope or technologically required minimum of inputs). Therefore, the later either stay out of these new businesses or have to integrate into larger or non-farm ventures. However, assuring the effective traceability of the origin and quality for small farms is very costly and they are not preferable partner for integrators (processor, retailers, and exporters). What is more, the internal market for organic and specialized farm products would unlikely develop fast having in mind the low income of population and the lack of confidence in public and private system of control.

Some economic and/or ecological needs (such as economizing on scale and scope or high interdependency of assets) would continue to bring about a change in size and governance of individual farms and/or evolution of group organization, cooperation, and joint ventures. For instance, a big interdependency of activities require concerted actions for achieving certain eco-effect; a high asset dependency between livestock manure (over) supplier and nearby (manure demanding) organic crop farms necessitate a coordination etc.

A special governing size and/or mode will be also imposed by some of the institutional requirements. For example, a mandatory minimum scale of activities is set for taking part in certain public programs (e.g. marketing, agri-ecology, biodiversity, organic farming, tradition and cultural heritage); signing a 5 year public environmental contract dictate a long-term lease or purchase of managed land etc. Our recent survey has proved that as much as 41% of the non-cooperative farms and 32% of the cooperatives are in the middle of investigation of

possible membership in a professional organization. Producers grouping are further stimulated by the available new public support (training, advising, funding) for farmers association.

Some of the existing production cooperatives would also profit from their comparative advantages (interdependency and complementarily to individual farms, potential for exploring economy of scale and scope on institutionally determined investment, adapting to formal requirements for support, using expertise, financing and executing projects, non-for-profit character etc.), and extend their activities into eco-projects, environmental services, eco-mediation between members etc.

An immediate result of the new market and public opportunities for getting additional benefits (income, profit) from environmental products and services will be an amelioration of the economic and eco-performance of a number of farms and rural households and augmentation of agro-ecosystem services flow.

The CAP implementation will push modernization of farms structures through widening the variety of contractual and organizational innovations - specific sort of contracts, new types of producers associations, spreading vertically-integrated modes etc. Special forms are also emerging, allowing agents to take advantage of large public programs which specialize in project preparation, management, and execution; invest in "relations capital" or "negative" entrepreneurship; form modes for lobbying and representation; make coalitions for complying with formal criteria (e.g. minimum size of utilized agricultural area for direct and agro-ecology payments, membership requirements for producers' organizations) etc.

CAP measures and enhanced competition will foster the restructuring of commercial farms according to modern market, technological, environmental and institutional standards. A large part of agrarian inputs, technologies, and outputs is increasingly having a "mass" (standardized) character, and market transacting dominate at farm gates. There is also a parallel tendency toward specialization into productions for "niche markets" and products with special quality - specific origins, special technologies, special quality etc. All that will require investments with higher specificity to a particular buyer(s), and "integrated" management of activity in farming, environmental conservation, processing, retailing, exporting. Besides, some diversification of enterprises into related activities (trade with origins, agro-tourism) for dealing with market risk is to grow. All these will bring more new, special modes for private governance such as long-term contracts, collective agreements (codes of professional behavior), trilateral modes (independent third-party certification/control), "quasi" or complete integration.

In the new market and institutional environment many livestock farms are less sustainable because of the low productivity and competitiveness, and non compliance with the EU quality, hygiene, animal welfare and eco-standards. That is particularly truth for the small-scale unregistered producers which dominate the sector. A few livestock farms will be able to adapt through specialized investment for enlargement and conforming to the new institutional restrictions by the deadline for full compliance (end of 2009) and will be closed, take-over or restrict to subsistency. The reduction of farms and animals, and improved manure management, will be associated with a drop of the environmental burden by the formal sector (less over-grazing, fewer manure production and mismanagement etc.).

Few subsistence and semi-market farms would undertake market orientation and extend their present scale because of the high costs for farm enlargement and adjustment - no entrepreneurial capital and resources available, low investment and training capability of aged farmers, and insufficient demand for farm products. Specific support to "semi-market" farms would have no considerable impact on subsistency because of the inappropriate criteria[74] and

[74] The same criteria as in other EU countries for defining "semi-market farms" is used – farms with a size of 1-4 European Size Units (1ESU=1200 Euro). However, for the Bulgarian conditions an income

the insufficient level of support. Besides, this measure focus on less prospective structures (small semi subsistence holdings) with low potential for adaptation to volume, quality, safety, animal welfare and environmental requirements, and needs of processors and distributors. Experience have proved that for the first two years of implementation of the measure "semi-market farms" only few thousands applications have been actually made (around 5% of initially projected number of potential beneficiaries)[75].

In addition to all these, for the authority is practically (technically, politically) impossible to enforce the official standards in that huge informal (subsistence, semi-market) sector of the economy. Therefore, massive (semi) subsistence farming with primitive technologies, poor food safety, environmental and animal welfare standards will continue to exist in years to come.

Enforcement of most labor, animal welfare, environmental, biodiversity etc. standards is very difficult (or impossible) and that is particularly truth for the huge informal sector of the economy (high political and economic costs). Here individual "punishments" do not work well while overall damages from the incompliance are immense. That is why policies should be oriented to market orientation of subsistence farms, support and incentives for collective modes, and eco-programs for informal farms and groups. Principally, public support to voluntary environmental initiatives of farmers and rural organizations (informing, training, assisting, funding) and employment of other hybrid modes (public-private; public-collective) would be much more effective than mandatory or pure public modes (given incentive, coordination, enforcement, and disputing advantages). Furthermore, involvement of farmers, farmers organizations, and interests groups in priority setting and management of public programs at all level is to be institutionalized in order to decrease information asymmetry and possibility for opportunism, diminish costs for coordination, implementation and control, and increase overall efficiency and impact.

All surveys show that many of the specific EU regulations are not well known by the implementing authorities and majority of farmers (Bachev, 2008). What is more, our recent study indicates that as much as 47% of non-cooperative farms and 43% of cooperatives are still "not aware or only partially aware" with the support measures of CAP different from the direct payments. Furthermore, as much as 62% of the farms report that they will not apply for such support due to the "lack of financial resources" (26%), "not compliance with formal requirements" (18%), and "clumsy bureaucratic procedure" (17%). Above and beyond, most of the farm managers have no adequate training and managerial capability, and are old in age with a small learning and adaptation potential.[76]

Thus improving education and training of various agents (farmers, rural residence, consumers, administrators) and relaxing of (some) eligibility criteria for public support is essential. In that respect improving organization (access, efficiency) and programs (e.g. environmental and project management) of National agricultural advisory service is crucial.

In addition, "blank points" in current legislation is to be properly filled. For instance, terms "ecosystem services" and "agro-ecosystem services" have to find an adequate place in the official regulations. Similarly, "the whole farm" is a subject of support in agri-environmental measures (such as organic farming, agro-ecology) but its borders are not defined at all in the national directives. That creates serious difficulties since land and other resources of the majority of farms are considerably fragmented and geographical dispersed.

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within this range is quite big (above the average for agriculture and other sector of the economy) to be considered as "semi-market" activity.

[75] Currently it is under consideration the redesign of that measure and redirection of funding to other areas where demand in big such as "Support to young farmers" and "Modernization of farms".

[76] The average age of the farm managers is 61 as 70% of them are older than 55 (MAF).

The lack of readiness, experiences, and potential for adaptation in public and private sectors alike would require some time lag until the "full" implementation of the CAP in "Bulgarian" conditions. The later will depend on the pace of building an effective public and private capacity, and training of (acquiring learning by doing experience by) bureaucrats, farmers, and other agrarian agents. As a consequence, farms modernization and adaptation will be delayed, and their competitiveness and contribution to agro-ecosystem services diminished. Moreover, there will be significant inequalities in application (and enforcement) of new laws and standards in diverse regions, sectors of agriculture, and farms of different type and size.

Last but not least important, there is a growing competition for environmental resources between different industries and interests. That push further overtaking the natural resources away from the farm governance and change into non-agricultural (urban, tourism, transport, industry etc.) use. The needs to compete for and share resources would deepen conflicts between various interests and social groups, regions, and even with neighboring states. All that would require a special governance (cooperation, public order, hybrid form) at local, national and transnational scales to reconcile conflicts related to ecosystem services.

Conclusion

Agro-ecosystem services have always been an important factor for human welfare. Their specific character and evolution depends both on the "Rules of nature" and the development of society (progress in demand and technologies, "rules of the game"). The effective supply of agro-ecosystem services is eventually determined by the efficiency of specific governance put in place. The late (is to) includes preset formal and informal rules (the institutions environment), voluntary initiatives of individuals, "invisible hand of market", negotiated or set by "manager's hand" private order, collective actions (cooperation, codes of behavior), public modes (public order, support, provision), and hybrid organizations (trilateral, multilateral and transnational modes).

In order to improve the eco-behavior of individuals we have to assess the comparative efficiency of alternative modes of governance of agro-ecosystem services - their potential to protect and reconcile interests, and minimize costs of transacting of beneficiaries, contributors, destructors etc. Analyses of the specific institutional and transaction structure let us also identify market, private and public "failures" and needs for (new) public intervention. Furthermore, it let evaluate efficiency of feasible modes for public involvement (assistance, regulations, property rights modernization, international cooperation) and predict likely failures in agro-ecosystem services.

Our analysis has demonstrated that post-communist transition and EU integration has brought about significant changes in the state and governance of agro-ecosystems services in Bulgaria. Newly evolved market, private and public governance has led to significant improvement of part of agro-ecosystems services introducing modern eco-standards and public support, enhancing environmental stewardship, desintensifying production, recovering landscape and traditional productions, diversifying quality, products, and services. At the same time, it is associated with some new challenges such as unsustainable exploitation, lost biodiversity, land degradation, water and air contamination etc.

Our analysis also shows that implementation of the common EU policies is having unlike results in "Bulgarian" conditions. In short and medium term it will enlarge income, technological, social and environmental discrepancy between different farms, sub-sectors and regions. In a longer-term environmental hazard(s) caused by the agricultural development will enlarge unless effective public and private measures are taken to mitigate the existing environmental problems. What is more, the specific structures for governing of farming activity (small commercial semi-market and self-sufficient farms, production cooperatives, large business firms) will continue to dominate in years to come. Nevertheless, a significant improvement of public (Government, EU etc.) interventions is needed in order to enhance sustainability of prospective farms and sustainable agrarian development. More specifically, implementation of EU common (agricultural, environmental, regional development etc.) policies would have no desired impacts (on socio-economic development, regional and sectoral discrepancies, flows of agro-ecosystem services etc.) unless special measures are taken to improve management of public programs, and extend public support to dominating small-scale and subsistence farms.

The identification of efficiency, complementarities, and sustainability of different modes of environmental governance has a substantial importance for amelioration of public policies, business strategies, and individuals and collective actions. Firstly, it helps anticipate possible cases of market, private sector, and public (community, Government, international assistance) failures, and design appropriate modes for public intervention. In particular, it facilitates

formulation of specific policies and institutional framework to overcome the existing environmental problems, and safeguard against the possible eco-risks, and avoid the severe environmental challenges in other developed countries. Next, it could assist individual, business, and collective actions, and organizational modernization in agrarian sphere for successful adaptation to changing economic, institutional and natural environment.

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