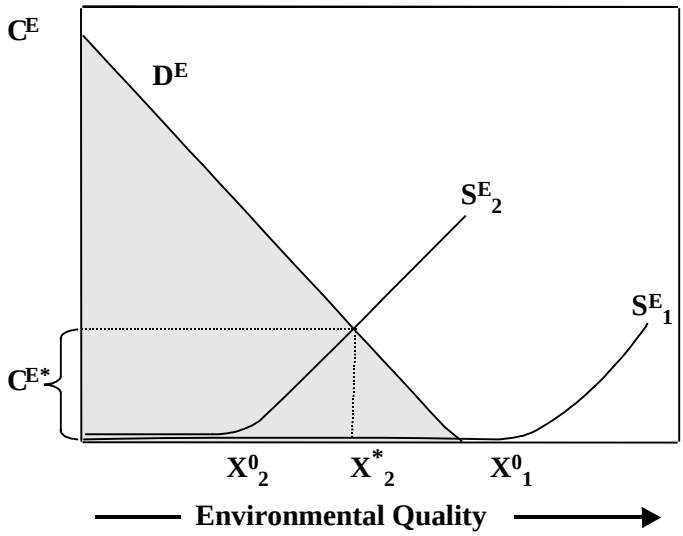
Annex 4.

Joint Provision of Environmental Impacts (Outputs) of Agricultural Production



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This figure represents the economic relationship between agricultural production and the associated environmental outcome (externality or output), where: S^E represents the supply curves of a specific agricultural commodity with the associated level of environmental quality X^0 under two different economic situations; D^E represents the demand curb expressing the society's preferences for the environmental outcome; and C^E represents the cost to achieve a given level of environmental quality.

Under the first situation the level of agricultural production corresponds to the individual production optimum that provides the level X^0_1 of environmental quality. With the supply curve S^E_1 the marginal cost of providing higher environmental quality become positive only beyond X^0_1. But, as society' preferences as represented by D^E are below X^0_1 there is no reason to increase environmental quality. In this case the environmental quality demanded by the society is an externality fully satisfied at zero additional costs.

Changing economic conditions in commodity production (situation 2) that creates a reduction in commodity prices and pushes farmers towards either more intensive production or use of less land area would change the commodity supply curve to S^E_2 and reduce the level of environmental

quality to X^0_2. The latter is the level of environmental quality resulting from the individual optimisation of commodity production under these new economic conditions.

Under these conditions, any increase on the environmental quality beyond X^0_2 would create positive marginal costs as indicated by the upward slope of S^E_2. The social optimum of environmental quality would be achieved where the supply curb S^E_2 intercepts the demand curve D^E. At this point, agricultural production would generate the social optimal level of environmental quality X^*_2. To generate this level of environmental quality farmers have to change the allocation of resources used to produce the commodity in order to specifically produce the desired environmental quality X^*_2 that ceases to be an externality and becomes a joint output with agricultural production. As this environmental output has the characteristics of a public good or service for which there is no market, it would be provided by farmers only if there would be incentives to cover the unit costs C^E.

Annex 5.

Environmental Reference Levels: Allocation of Costs and Benefits Associated With Environmental Quality

Environmental reference levels mark the borderline between the activities farmers can carry out with the associated environmental effects according to their own interests, and the activities for which they are obliged to mitigate the associated environmental effects at their own expense (property rights). Thus a key issue is whether reference levels should be set in terms of the environmental outcome, or the appropriate farming practices (for example, maintaining buffer zones along water courses) or emission levels (for example, the quantity of sediments, nutrients, and pesticides in the water courses) to achieve such outcome. Given the non-point source nature of many environmental impacts of agriculture they cannot always be defined in terms of emission levels. This is why the environmental performance of agriculture is often defined in terms of the best available technology for generating a given level of environmental quality, rather than in terms of a desired emission level. The value of environmental quality is often difficult to establish, but it can sometimes be defined in physical terms (for example, number of specific plant species on a chalk meadow).

In contrast to the case of industry, the environmental effects of agriculture are in many cases closely related to land use for which traditional or "presumptive" property rights can be claimed. When traditional or "presumptive" property rights in land gain priority over societal claims for certain land-use-related environmental qualities (soil and water quality, and bio-diversity) the pursuit of environmental objectives may infringe on such rights and, therefore, may require compensation for the expropriation of such property rights. Thus, this expropriation implies a change from presumptive rights into effective rights defined by the reference level. There are also cases where environmental reference levels evolve together with technological progress and economic growth and tend towards specific ***environmental targets*** for soil, water and air, which are quality levels considered desirable for the ecosystems, *i.e.* for human health and live habitats.

The definitions of environmental targets and reference levels vary between countries. Environmental targets depend on society's preferences for environmental quality, while reference levels depend on the country's traditions in defining property rights. The efficient setting of environmental targets has to balance the benefits of pursuing environmental objectives against any resulting welfare losses due to lower production or consumption of other goods and services. In other words, the overall welfare optimum is achieved by reflecting the environmental quality that can be achieved in the light of the prevailing technological conditions and societal preferences for all goods and services. But, whereas the setting of environmental targets is based on "eco-efficiency", or ecological or human health considerations, the issue of identifying the relevant environmental reference levels (who should bear the costs of reallocating resources to meet environmental targets) is based on distribution (equity) considerations and property rights.

Chart A5.1 illustrates four different cases to which farmers may be confronted in relation to such parameters (where X represents the level of environmental quality corresponding to environmental targets (X^T); reference levels (X^R); and current farming practices (X^C)). All cases (A to D) represent an identical environmental outcome and allocation of farm resources as the environmental target X^T is the same. What differs among these cases is the distribution of costs associated with achieving the defined environmental target (*i.e.* who pays or who is charged).

- ***Case A*** represents a situation where current farming practices provide a level of environmental quality corresponding to a reference level ($X^C=X^R$) above the

environmental target (X^T). Thus, farmers are already using the farming practices required for achieving the socially desired environmental outcome. With X^T and X^R achieved at zero opportunity costs, *no policy action* is needed. In such case, the reference level X^R would normally be achieved through current farming practices X^C (here referred to as "good farming practices").

- ***Case B*** represents a situation where current farming practices (X^C) provide an environmental performance below the reference level defined at the level of the environmental target ($X^T=X^R$). In this case, farmers need to adopt farming practices required to achieve the desired environmental target level (X^T) *at their own expense*, which is consistent with their own property rights and the PPP. However, applying the instrument of transferable discharge permits[1], could also permit to achieve the desired environmental quality.

- ***Case C*** represents a situation where current farming practices achieve an environmental performance corresponding to the reference level ($X^C=X^R$) that is below the target level (X^T). As in this case property rights in land use are attributed to farming practices achieving an environmental reference level below the environmental target level, farmers *may need to be compensated* for changing from current farming practices (X^C) to practices required to achieve the environmental target (X^T). This is consistent with the PPP as this principle does not imply an uncompensated expropriation of private property rights where the productive use of privately owned resources and factors of production competes with the pursuit of environmental objectives. However, environmental policies often face a legal context where property rights in land use are merely "presumptive" rights without being based on explicit legal definitions. In such cases, the definition of property rights might well move from presumptive rights at X^C to more restrictive ones at X^T.

- ***Case D*** represents a situation similar to Case C where current farming practices (X^C) provide an environmental performance below the environmental target level (X^T), but with the reference level above the environmental performance level of current farming practices (X^C) and below the environmental target (X^T). For improving their environmental performance, farmers need to adopt appropriate farming practices *at their own expenses* up to the reference level (X^R). Requirements for farmers to further improve their environmental performance beyond X^R (for example, to reach the environmental target X^T) may need adequate compensation, but might in some cases be only transitional.

Good farming practices are usually site and farm system-specific. They depend on natural conditions, types of production systems, agricultural structures, and social perceptions. Therefore, good farming practices and the associated level of environmental performance is not a unique point on the scale of environmental quality. It can vary from country to country and region to region. For example, good farming practices in mountain areas would be different from that in lowland areas or countries differ in their attitudes towards poultry produced in batteries and those raised in the open.

1. Permits that specify an allowable rate of pollution that can be bought or sold.

Chart A5.1. Allocation of environmental costs and benefits