

## Extended abstract for Contributed Paper session

<b>Paper Title</b>	<b>Using emission intensity measures as a guide to national mitigation policies for agriculture and land use</b>
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**Contributed Paper abstract prepared for presentation at the 91<sup>st</sup> Annual Conference of the Agricultural Economics Society, Royal Dublin Society in Dublin, Ireland**

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<b>Abstract</b>	<b>200 words max</b>
<p>We explore the ability of physical and economic measures of emissions intensity to provide guidance for mitigation policies for agriculture and land use. Using data from the United States, the ability of various measures to prioritize agricultural activities for GHG reduction efforts is examined. We argue that economic measures are superior to physical measures as a guide to policy, given the importance of development and other policy objectives in many countries. We demonstrate that mitigation priority rankings can be affected by the emissions measure used. We conclude that a measure of emissions intensity based on value added is superior to physical emissions measures and to measures based on total value of output. Use of a value added approach has a number of analytical advantages, including the ability to reflect more comprehensively the policy set that might be available to policymakers in pursuing mitigation and other policy objectives.</p>	
<b>Keywords</b>	Climate change; emissions intensity; mitigation priorities
<b>JEL Code</b>	Q58: Environmental Economics: Government Policy
<b>Introduction</b>	<b>100 – 250 words</b>
<p>The recent entry into force of the UN global climate agreement is an important step in addressing the challenge of global climate change. Signatories to the agreement have indicated, with varying degrees of specificity, goals for the reduction of national greenhouse gas (GHG) emissions. Many countries have indicated that the reduction of emissions from agriculture and land use will form part of their national GHG-reduction strategies.</p> <p>The IPCC has estimated that agriculture and land-use accounted for 24% of global GHG emissions in 2010, making this the second leading contributor to global emissions after electricity and heat production (25%). Unlike other sectors, however, agriculture and land use provides an important carbon sequestration function that offsets roughly 20% of the sector’s emissions. But the sector is also a major source of two potent GHGs – methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). In many countries, particularly in the developing world, reducing emissions from agriculture will be extremely challenging due to increasing demand for food and agricultural raw materials.</p> <p>In order to reduce the overall volume of GHG emissions, countries face the need to identify potential targets for mitigation activities in the agricultural and land-use sector. To achieve GHG reduction targets requires, at a minimum, that the emissions</p>	

intensity associated with agricultural production be reduced. Also possibilities for the expansion of carbon sequestration activities need to be identified. Consequently, the measurement of emissions intensity and how such measurement can be used to guide potential mitigation policies are important issues.

<b>Methodology</b>	<b>100 – 250 words</b>
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Considerable attention has been directed towards the measurement of physical emissions intensity. The emissions associated with particular agricultural activities have been estimated and expressed, for example, per hectare, per animal, or per ton of product. We discuss the derivation of these measures and the contribution they make to identifying potential targets for emissions reduction.

Physical emissions ratios do not take into account the contribution that agricultural and land-use activities make to the national economy. Deriving measures to reflect this is clearly important for policy purposes. Countries face the challenge of balancing the need to limit the contribution of agriculture and land-use activities to climate change (minimizing a global negative externality) while simultaneously maintaining or enhancing the contribution of these activities to the national economy (maximizing the contribution to national income and other economic objectives, such as employment). In addition, the contribution of agriculture and land-use activities to local externalities (positive or negative) needs to be taken into account in policy formation.

We examine the role of economic measures of emissions intensity as a guide to mitigation policy. As an initial step, we examine indicators that are based on total output value. We then develop a more comprehensive approach based on a value-added framework. We discuss the contribution that each of these economic measures (and physical emissions measures) can make to potential policy choice. To illustrate the relevance of the measures we present comparative calculations based on data for the United States.

<b>Results</b>	<b>100 – 250 words</b>
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We find that different measures of emissions intensity can result in different rankings across commodities or activities in terms of mitigation priorities.

In contrast to physical measures, economic measures have the advantage of being able to take into account the potential impact of distortions created by existing support policies. Rankings can be affected by taking transfers associated with such policies into account.

We find that the value-added approach to measuring emissions intensity is superior analytically to the use of physical measures or measures based on the total value of output. In addition to other advantages, no actual or assumed price of carbon is needed to apply a value-added measure of emissions intensity.

From a policy perspective, not only does an approach based on value-added capture more accurately the economic contribution of various activities relative to the emissions they generate, it also allows for a more complete treatment of the policy set. Specific advantages in this regard include: analytical separation of policies linked to output and inputs; the ability to deal with unpriced or under-priced inputs, such as water and other positive or negative externalities associated with agriculture; and the

ability to assess the relative contribution of non-agricultural land-use activities such as forestry to mitigation objectives.

**Discussion and Conclusion**

**100 – 250 words**

The identification of priorities for GHG mitigation in agriculture and land use is extremely important if countries are to meet their objectives for an overall reduction in national emissions under the UN climate change agreement. In developing countries, given the anticipated pressure on agriculture resulting from growth in demand for food and agricultural raw materials, an assessment of the relative economic contribution of different activities, and how this can be balanced against the imperative for GHG mitigation, is clearly a central issue in sustainable development.

There is a need for improved measures of emissions intensity to guide agricultural policies in both developed and developing countries. We posit that the approach developed in this paper can enable economists to provide clearer insight into the issues for policymakers.