

## PLENARY SESSIONS

### PLENARY 1

#### ***CLIMATIC EFFECTS AND AGRICULTURAL PRODUCTIVITY ANALYSIS***

**Keith Fuglie:** Moderator, United States Department of Agriculture-ERS

**CHRIS O'DONNELL:** University of Queensland, Australia

**Abstract:** Productivity is defined as a measure of output quantity divided by a measure of input quantity. I measure changes in outputs and inputs (and therefore productivity) using indices that satisfy common notions from measure theory (e.g., proportionality, transitivity). I show how changes in outputs and inputs can be explained using economic models of production processes and managerial behaviour. I subsequently show how changes in productivity can be attributed to technical change (i.e., the discovery of new technologies), environmental change (i.e., changes in variables that are physically involved in the production process but never chosen by managers), and various types of efficiency change (e.g., technical, scale and mix efficiency change). To illustrate, I measure and explain changes in U.S. agricultural productivity between 1960 and 2004. My focus is on the role of weather and climate. I find that changes in productivity were mainly driven by changes in rates of technical progress and changes in scale and mix efficiency. I find that the effects of weather and climate were relatively small. I conjecture that changes in rates of technical progress were mainly driven by changes in research and development expenditure. I find that changes in scale and mix efficiency were mainly driven by changes in input prices.

### PLENARY 2

#### ***FARM PRODUCTIVITY & WATER: ECONOMICS MEETS AGRONOMICS***

**Roberto Jara:** Moderator, Universidad de Talca

**SAMUEL ORTEGA:** Universidad de Talca

**LILYAN FULGINITI:** University of Nebraska, Lincoln

**Abstract:** Dr. Ortega, with the collaboration of Rodrigo Morales and Mario Toledo, focuses on the evaluation of the integrated system for irrigation management to optimize water productivity in agriculture. He indicates that in Chile, water available for irrigation has diminished in recent years due to frequent drought and strong competition for water resources among agriculture, industry and urban areas. In this regard, the Research and Extension Center for Irrigation and Agroclimatology (CITRA) at the "Universidad de Talca" created the Integrated System for Irrigation Management (SIGESH) to improve water productivity (WP = kg of product per m<sup>3</sup> of applied water) and optimize yield and quality of agricultural products. SIGESH integrates soil, climate, and variety information with satellite images to advise farmers about irrigation scheduling of crops, fruit orchards and vineyards. Thus, the objective of his presentation is to describe SIGESH for improving WP and yield using climate and soil data in combination with remote sensing images. The presentation will describe methodologies to estimate crop water requirements and water balance at the farm level. The main results indicate that SIGESH has been able to increase water productivity from 0.24 to 0.34, 1.67 to 3.73 and 7.81 to 23.7 kg m<sup>-3</sup> for seed production (corn and sunflower), fruit orchards (apples, kiwifruit, blueberry and raspberry) and vineyards, respectively. Also, data analysis shows that SIGESH has reduced water application between 20-60% and increased yield between 8-15%.

**Abstract:** Dr. Fulginiti argues that the very existence of the concept of productivity gain, an increase in output per input, is due to its implications for improved human welfare. Despite this human welfare motivation, the productivity literature has tended to focus on the production process itself to measure productivity change. In her presentation, Dr. Fulginiti discusses the concept of water productivity and the

impact of water on agricultural productivity and welfare. She emphasizes issues related to the unpriced or 'poorly priced' nature of this resource and the challenges involved in extracting the 'value' of water in uses where it behaves as a common property resource and no markets are present. She provides a contrast of some relevant notions such as average versus marginal product concepts, single versus multifactor productivity measures, private versus social shadow prices, present versus future values as they relate to water productivity. A number of examples are presented to illustrate the concepts and to show that a comprehensive assessment of average as well as marginal product of water necessitates the cooperation between economics, and the biophysical and political sciences.

**PLENARY 3**  
***PUBLIC EXPENDITURES IN AGRICULTURE: IS THERE ROOM FOR IMPROVEMENT?***  
***EVIDENCE FROM LATIN AMERICAN AND CARIBBEAN (LAC) COUNTRIES***

**Federico García:** Moderator, Universidad de la República, Uruguay

**PEDRO MARTEL:** Inter-American Development Bank

**Abstract:** The economic literature on the effectiveness of the use of public financial resources shows that investments aimed at providing rural public goods (e.g., rural infrastructure, technological innovation, plant and animal health, market information, and natural resource stewardship) brings higher economic returns and has a bigger impact on productivity, income, and sustainable management of natural resources than does public spending aiming to provide private goods (e.g., buying and distributing inputs, production subsidies). The evidence shows that shifting expenditures on the financing of private goods toward rural public goods increases rural per capita income, reduces adverse impacts on natural resource management, and contributes to poverty reduction (Lopez and Palacios, 2014; Lopez and Islam, 2011; Lopez and Galinato, 2007; Sills et al., 2015). In Latin America, and in the Caribbean in particular, the evidence suggests that the breakdown of rural public spending is more important than the size of the expenditure. In fact, a recent study, using agricultural public spending data from 19 countries in the LAC region for the period 1985-2012, finds that redistributing 10% of total public expenditures on private subsidies toward public goods could increase per capita agricultural income by approximately 5% (Anriquez et al., 2015). The evidence on effectiveness and returns associated with investments in rural public goods suggests that there is room for improvement in the structure of agricultural public spending in Latin America. In fact, on average, 13 LAC countries allocated less than half their public expenditures to public goods. This paper analyzes the different trends on public expending in the LAC region in order to identify possibilities for improvement.

**PLENARY 4**  
***REFLECTIONS ON AGRICULTURAL R&D, AND PRODUCTIVITY***

**Walt Armbruster:** Moderator, Farm Foundation USA, retired

**JULIAN ALSTON:** University of California-Davis

**Abstract:** Sixty years ago, T.W. Schultz introduced the idea of the productivity "residual" to agricultural economics. His main message was that growth in conventional inputs accounted for little of the observed growth in agricultural output, and that there was work to be done by agricultural economists to understand and ultimately eliminate this unexplained residual called "productivity." Thus, was launched the economics of agricultural productivity as a sub-field within agricultural economics, along with the economics of agricultural R&D and innovation and related government policy. Much progress has been made in the decades since. Still, critical issues remain unresolved. This matters because agricultural innovation and productivity matter, and so do the related policies that rest to some extent on our established understanding of the economic relationships. This presentation reviews some unsettled issues related to economic models and measures applied to agricultural R&D and productivity, and some unfinished business in terms of economic and policy questions that are not yet well answered.