New Zealand Agricultural & Resource Economics Society (Inc.)

Water and Agriculture: Drawing on the Policy Experience across OECD Countries towards the Sustainable Management of Water in New Zealand

Kevin Parris
Trade and Agriculture Directorate
OECD, Paris

Paper presented at the 2011 NZARES Conference

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Drawing on the Policy experience across OECD countries toward the sustainable management of water in New Zealand

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Presentation to the New Zealand Agriculture and Resource Economics Society Conference, Nelson, New Zealand, 11.00, 26 August 2011

OECD AND ITS GLOBAL PARTNERS

Membership has expanded over OECD's 50 year history to embrace 34 countries and the European Union:

- Australia
- Austria
- Belgium
- Canada
- Chile
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Israel
- Italy
- Japan
- Korea
- Luxembourg
- Mexico
- Netherlands
- New Zealand
- Norway
- Poland
- Slovenia
- Portugal
- Slovak Republic
- Spain
- Sweden
- Switzerland
- Turkey
- United Kingdom
- United States

OECD is currently in accession talks with:

Russia

and enhanced engagement with G20 countries, including:

Brazil, China, India, Indonesia, South Africa

OECD Work on Water

Data

- **2nd Edition of Environmental Performance of Agriculture at a Glance**, 2012
- **Workshop on Improving Water Information Base, Zaragoza,** 2010

Policy: Agriculture and Water

- **Water and Agriculture: Adelaide Workshop,** 2006
- **Sustainable Management of Water Resources in Agriculture** 2010
- **Sustainable Management of Water Quality in Agriculture,** 2012
- **Agriculture, Water and Climate Change**, 2012
- **Sustainable Management of Water in Agriculture: Overview**, 2012

Policy: OECD Horizontal Project on Water

- **Managing Water for All,** 2009
- **OECD Global Forum on Water**, 25-26 October, 2011
- **Policy coherence between water, energy and agriculture,** 2012
- **World Water Forum**, Marseilles, France, 12-16 March, 2012

Linkages between agriculture and water: Framework of analysis and future challenges

The linkages between agriculture and water, complex, diverse, and dynamic compared to most other sectors:

- **Resource use**: major share of water withdrawals
- **Quality**: major share of nutrient, pesticide, soil pollution
- **Energy**: irrigation pumping and link to bioenergy feedstock
- **Droughts & floods**: both afflicted but can provide solutions
- **Ecosystems**: can have positive and negative impacts
- **Climate change**: vulnerability to change and variability

Linkages between policies, agriculture and water systems

Policies, Markets, Environment → **Agriculture Driving Forces** → **State of Water Systems** → **Agricultural impacts on water systems, with implications for:**

Policies
- ***Agricultural***
  Commodity support, irrigation support
- ***Agri-environmental***
  Payments for riparian buffers
- ***Environmental***
  Water pricing policies

Markets
Commodity markets, economy, technology

Environment
Soils, weather, climate change

Farm systems
'Conventional', Integrated, Irrigated, Organic

Farm practices
Nutrients and pesticide application, tillage and irrigation practices

Farm input use
Nutrients (N & P), pesticides, water, energy

Streams

Rivers

Lakes

Wells

Aquifers

Estuaries

Coastal waters

Deep seas

Human health

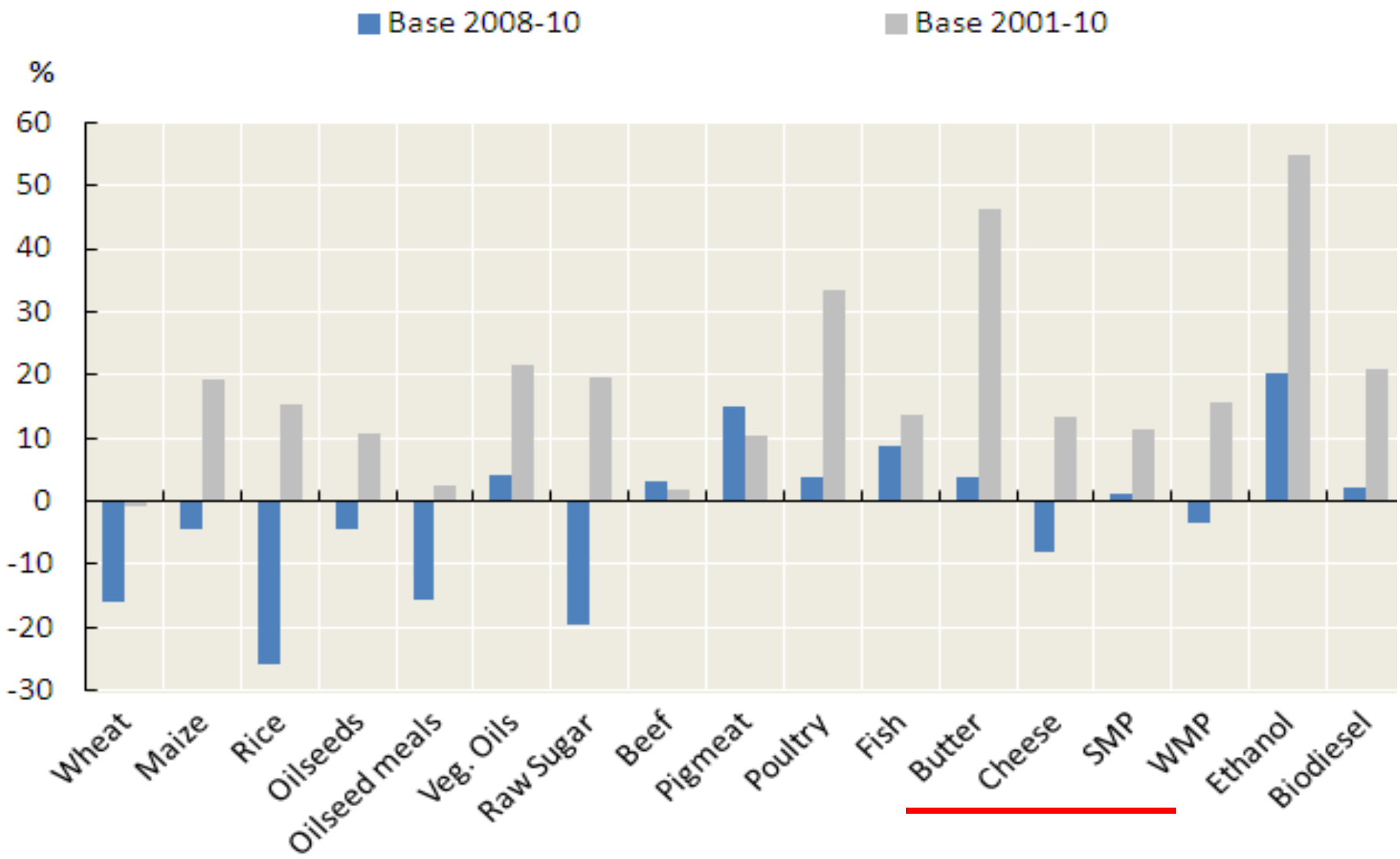
Social uses
Swimming, visual, Maori values

Agriculture, fisheries, industry

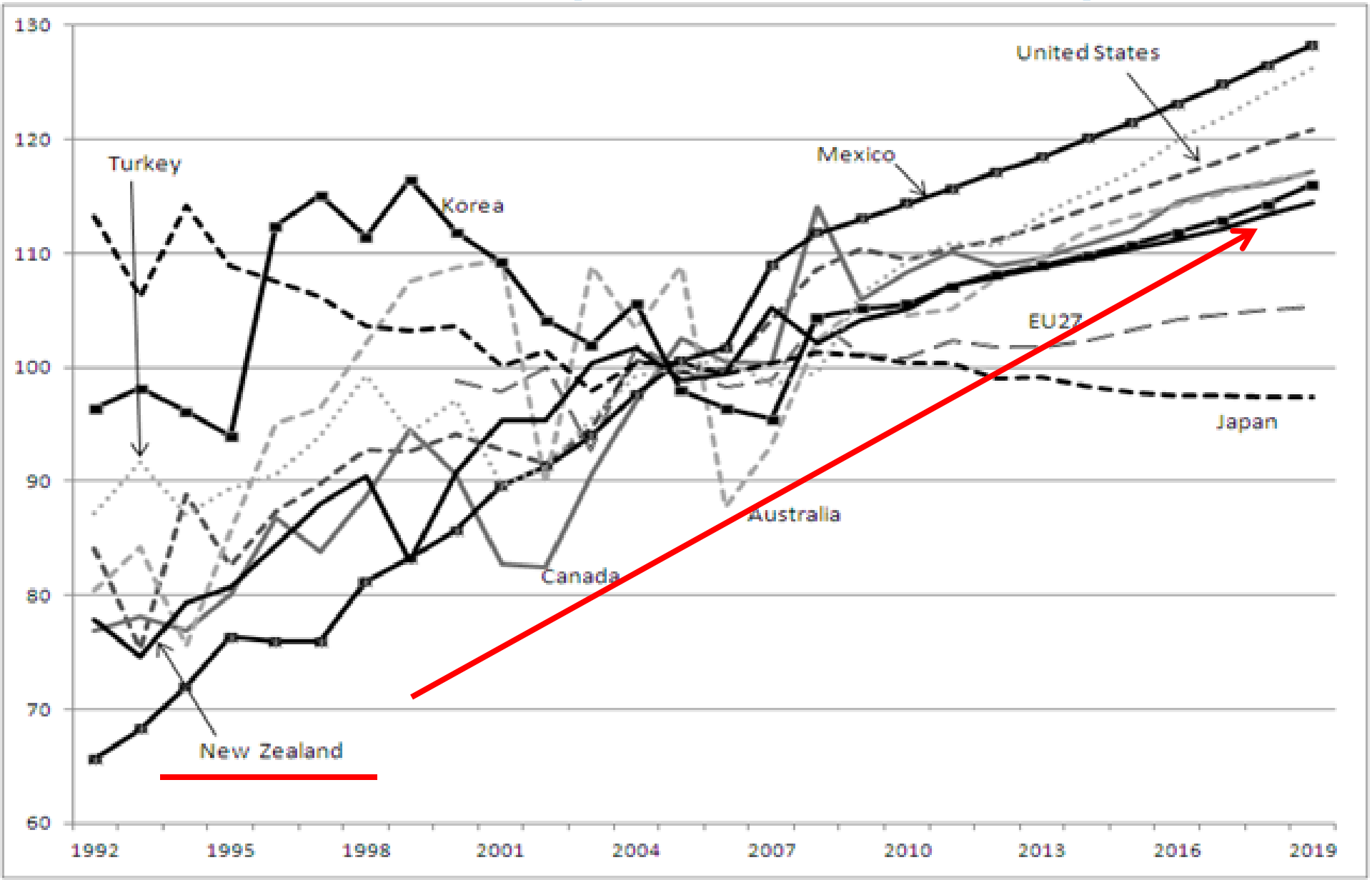
Environment
Freshwater and marine ecosystems

OECD-FAO Project Higher Commodity Prices

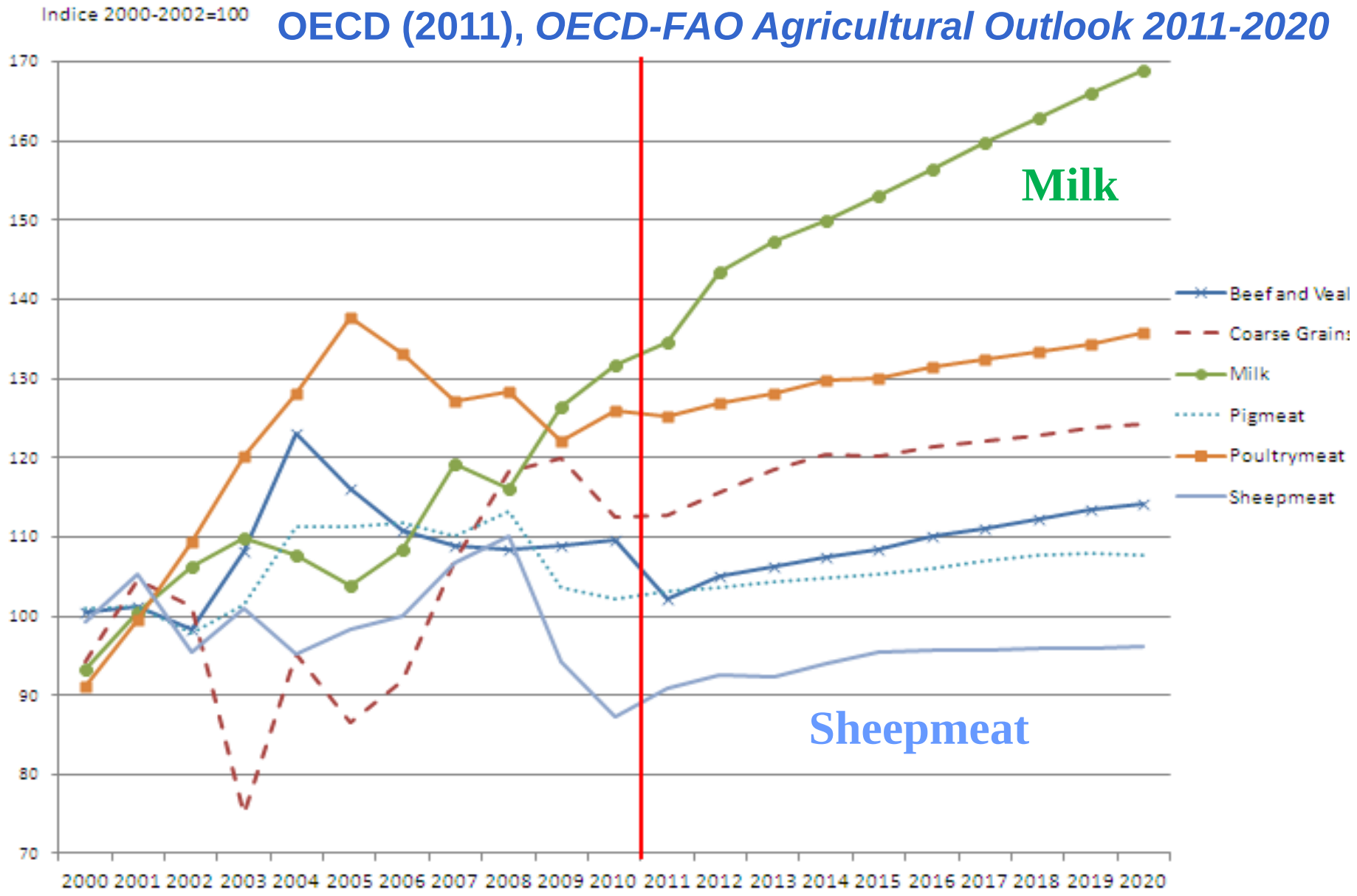
Percentage change in average 2011 - 2020 world prices in real terms relative to the 2008-10 and 2001-10 base periods



OECD-FAO projection for agricultural production 1992-2019 (Index 2004-06 = 100)



OECD-FAO agricultural commodity production projections: New Zealand 2011-2020 (Volume index)



Did Donald Rumsfeld (former US Secretary of Defence) have something important to say about climate change?

“There are known known's.
These are things we know that we know.
There are known unknowns.
That is to say, there are things that we know we don't know.
But there are also unknown unknowns.
There are things we don't know we don't know.”

Climate change (CC), agriculture and water resources

- Many OECD countries reporting growing incidence, severity and costs of floods and drought for agriculture
- In response countries beginning to develop mitigation and adaptation strategies, including efforts, for example, to:
  - improve water use efficiency;
  - alter farm practices and systems to adapt to climate change;
  - change management practices to slow water flows across farmland to protect urban areas and integrate into regional land use planning
- Approaches to CC likely to be more effective if embedded in long term strategies linked to agriculture & water policy reforms
- Better understanding of risk management approaches in agriculture will also help address CC

Climate change (CC), agriculture and water quality

- Higher water temperatures and extreme floods & droughts, are projected to aggravate many forms of water pollution
- Extent of increased contaminant run-off and leaching from agriculture highly dependent on contaminant type, soils, etc.
- Increased incidence and severity of flooding could mobilise sediments, associated contaminants, and exacerbate pollution
- More severe droughts may reduce pollutant dilution and lead to increasing toxicity problems
- Overall task of achieving water quality objectives in agriculture likely to be more difficult under CC, but research of CC, water quality, and agriculture linkages limited to date

Agriculture and Water Resource Management

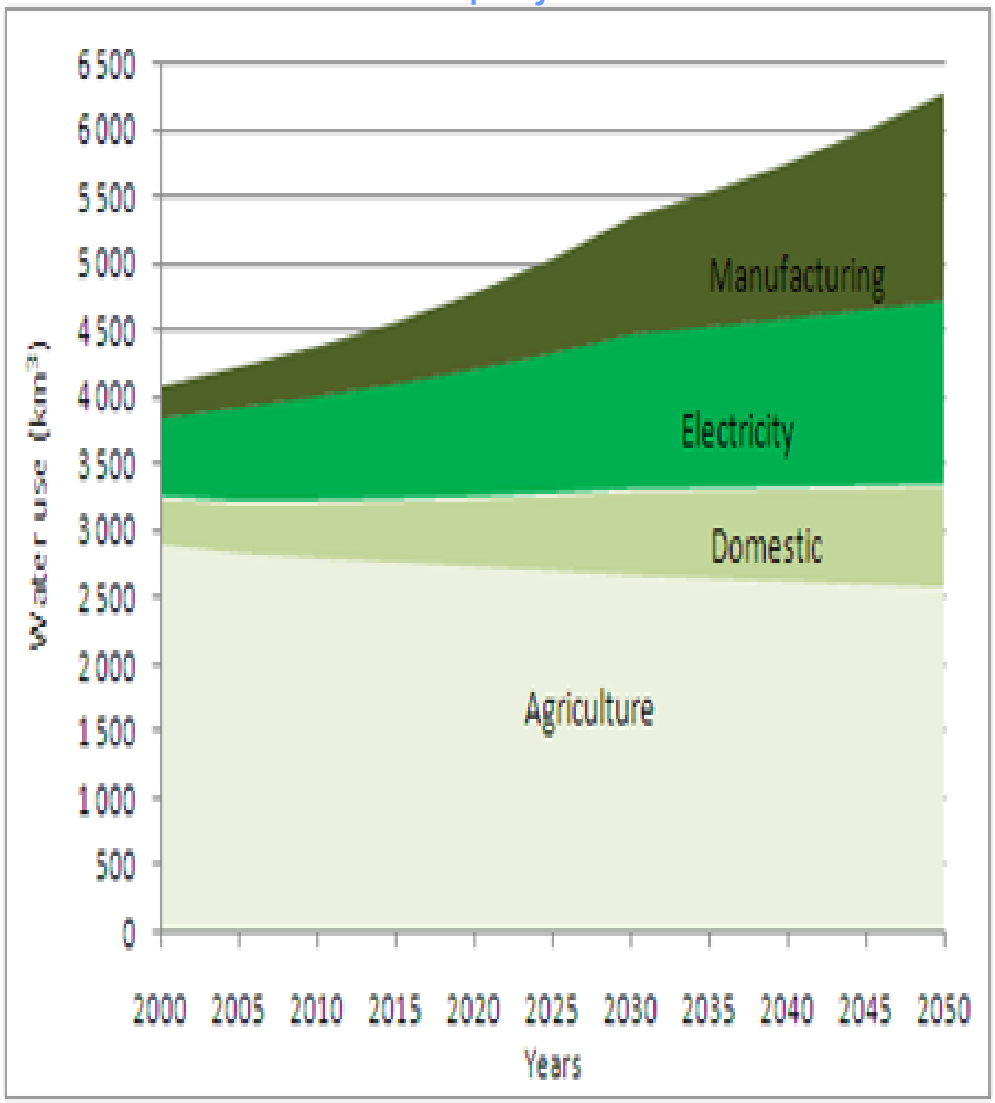
Global challenges for water resource management in agriculture

Key drivers impacting water resource use by agriculture:

- Growing world population from current 7 billion to 9 billion by 2050
- Increasing global food demand from 2000 baseline by 100% 2050
- Changing dietary habits towards more meat and dairy products (China)
- Expanding biofuel/bioenergy production from agri-forestry material
- Increasing public demand to meet environmental and social needs, e.g. river flows, recreational uses
- Land and water constraints
- Climate change

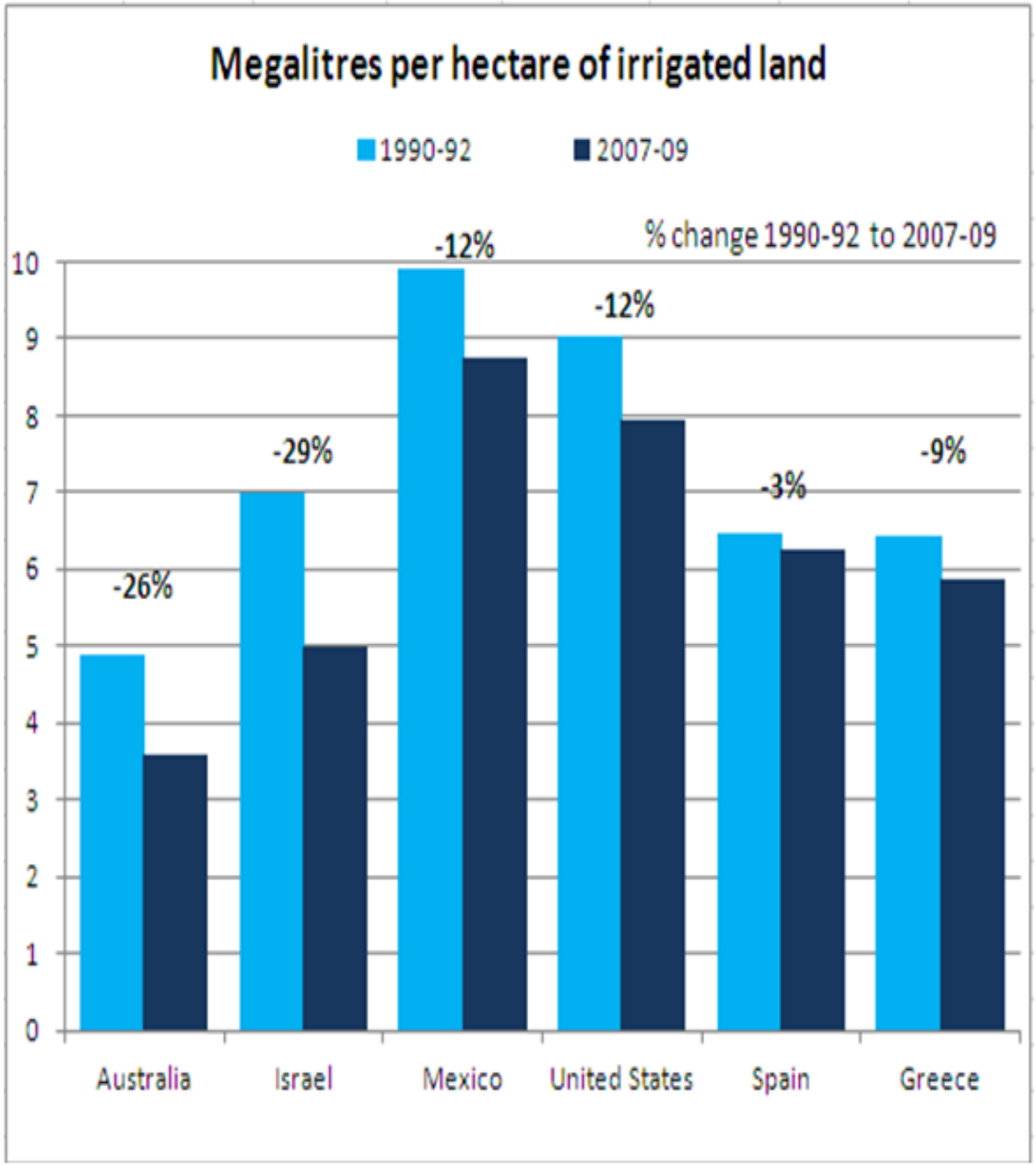
Water projections by sector

World water withdrawal projections: 2000–2050



Limits and potential to improve water use productivity in agriculture across OECD countries

- Major new irrigation development difficult, because of financial and physical limits (land & water) (NZ *Irrigation Acceleration Fund* $400 million over 10 years)?
- Some potential for agric. to recycle wastewater, but desalinated water marginal & costly for agriculture
- High priority to improve productivity of existing irrigation systems, and raise the water productivity of rain-fed systems
- OECD performance is uneven, partly reflecting varying water policy reform paths (No data for New Zealand)



Using water pricing and market incentives to improve water use efficiency in agriculture

- Most OECD countries have embarked on water reform programmes by making greater use of water pricing
- Great variation in farm water charges within and across countries, but cost recovery rates have been increasing
- Recovery of O&M costs common, but recovery rates for capital costs poor, and other policies often used to cover env. costs
- Higher water charges and reduced overall farm support has not led to reduced farm output or incomes, e.g. Australia, Israel
- Groundwater policies usually rely on licences and other regulatory measures, water pricing rare & illegal pumping occurs

Summary of cost recovery rates for water services to agriculture in OECD countries (c.2009)

- **100% recovery of Operation and Maintenance (O&M) and Capital Costs (CC):**

  Austria; Denmark; Finland; **New Zealand**; Sweden; United Kingdom

- **100% recovery of O&M Costs, but less than 100% recovery of CC:**

  Australia, Canada, France, Japan, United States

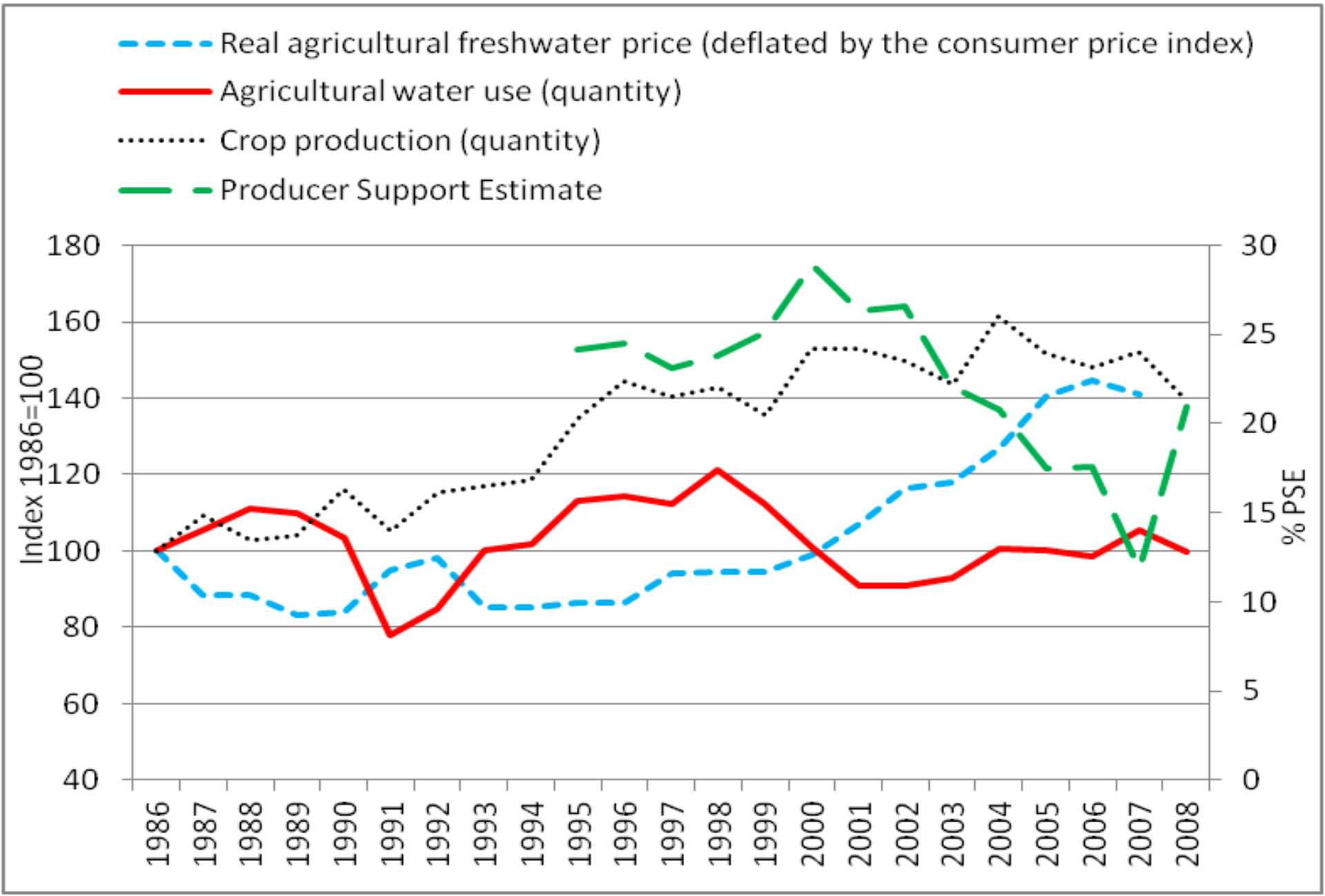
- **Less than 100% recovery of O&M and CC:**

  Greece; Hungary; Ireland; Italy; Mexico; Netherlands; Poland; Portugal; Spain; Switzerland; Turkey

- **Less than 100% recovery of O&M Costs, with CC fully supported:**

  Korea

Israel: Agriculture and Water Policy Reforms



Why do impediments to water market formation remain?

- Incomplete understanding of the science of water resource and ecosystem linkages
- Lack of physical networks between water delivery systems supplying different water users (agriculture, industry, urban)
- Poorly defined property rights, including that land and water entitlements are not usually separated
- Problems of defining, securing and agreeing among stakeholders in a catchment allocation of water for environment
- Concern with the high transaction costs in creating water markets, as well as equity and social concerns
- Frequently legal, administrative and institutional barriers to developing water markets

Key OECD messages in moving toward sustainable management of water resources in agriculture

- Recognise the complexity and diversity of water management
- Reform institutional systems governing water management
- Ensure charges for water at least reflect full supply costs
- Enhance agriculture's resilience to climate change
- Improve policy coherence between agriculture, water, energy and environment policies, e.g. remove perverse incentives
- Encourage uptake of technologies and improvements in farm management practices, supported by farmer advisory services
- Address knowledge and information deficiencies to better guide decision making from farm to national policy scale

Agriculture and Water Quality Management

The good ….

…the bad ….

…and the ugly.

Apologies to Clint Eastwood

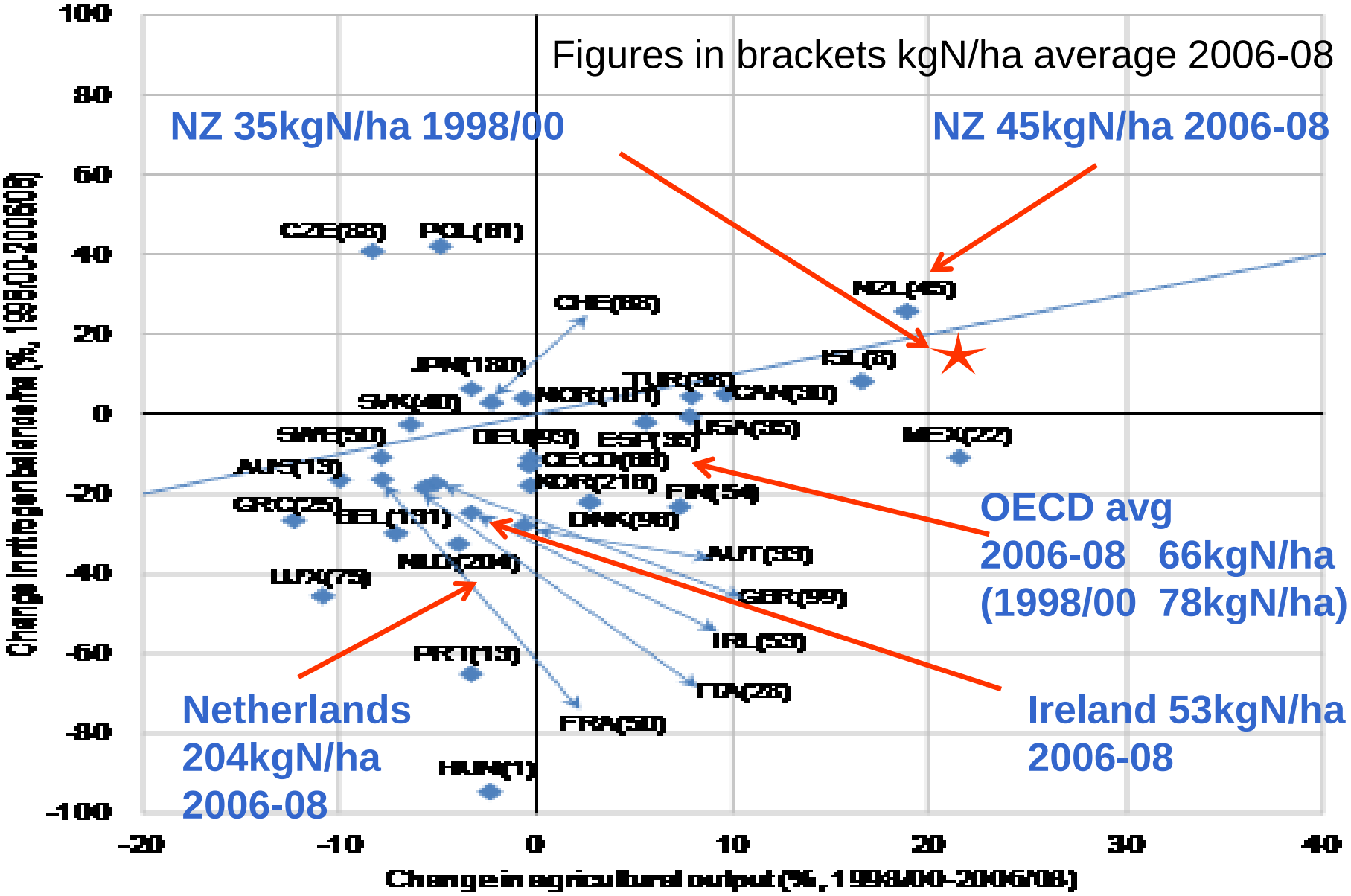
Challenges for agriculture and policy makers in addressing water quality issues

- Agriculture production generates externalities for which there are no markets although they can provide benefits (wetland conservation) or impose costs on society (water pollution)
- Challenge for agriculture is to meet growing demand for food, feed, fibre and fuel, while reducing/encouraging externalities
- Improving water quality a top environmental concern in public surveys, and with success in reducing urban/industrial point pollution, focus on agricultural diffuse & point source pollution
- Designing policies to control diffuse agric. pollution is complex:
  - Low pollution concentrations taking diffuse pathways into water system
  - Cumulative effects on water systems from pollution across large areas
  - Highly variable in space and time and commonly costly to monitor
  - Frequently require cooperation from sub-national to international scale

Overall trends for agriculture and water quality in OECD countries (c. mid-200s to 2010)

- Compared to 1990-mid 2000 period, impact of agriculture on water quality either stable or deteriorating, few cases of improvement, but highly variable within and across countries
- Where agriculture has contracted (expanded, NZ), overall pressure on water quality has eased (intensified, NZ)
- Disconnect between improvements in farm practices and water quality trends, largely linked to time lags
- Eutrophication of fresh and marine waters becoming more frequent and severe (64% of monitored lakes in pastoral NZ landscapes eutrophic or worse)
- Overall NZ water quality high relative to some OECD countries, but growing concern for NZ water systems, although water quality data related to agriculture needs improvement

Nitrogen balance versus agricultural output 1998/00-2006/08



The costs of agricultural water pollution are high for taxpayers, water utilities and consumers

- **Taxpayers** across OECD countries pay probably in excess of many billion dollars annually to assist farmers in reducing water pollution (e.g. riparian buffers, manure storage, farm advice).

- **Water treatment utilities and consumers** incur costs to treat water to remove farm and other pollutants to ensure water supplies meet drinking water standards

- **Other water users** also incur costs from water pollution, such as eutrophication of water bodies imposing costs on fisheries, impairing recreational uses,
  and damaging ecosystems,
  e.g. concern with
  Lake Taupo

National monetary costs of water pollution (not all due to agriculture)

Country (year of study)	Type of water quality impact	Monetary Cost (% share of Agriculture Value Added)	
		National Currency million	US$ million
Australia (2000)	Algal blooms linked to excessive nutrients	AUD 180 – 240	116 – 155 (1%)
France (2010)	Water treatment and eutrophication of surface and coastal waters	€610 – 2200	850 – 3060 (2% – 8%)
Netherlands (2010)	Total damage from nitrate and phosphorus	€403 – 754	371 – 695 (2% – 3%)
New Zealand (unpublished)	**Total cost of reducing nitrate pollution**	**NZD 18 – 130 (OECD estimate 2005)**	**26 – 185 (0.2% – 1.5%)**
United Kingdom (2007)	Total agricultural damage	GBP 232	464 (3%)
United States (2009)	Freshwater eutrophication	/	2200 (1%)

Recent OECD policy experience in addressing water quality issues in agriculture

- Mix of economic incentives (taxes, subsidies), regulations (manure spreading) and information instruments (farm advice) used to address pollution, has had varied results across OECD

- Policies have generally fallen short of requirements to meet water quality goals in agriculture mainly due to:

  - Inefficiency and failure in enforcing water pollution regulations
  - Increasing budgetary costs of support to farmers to control pollution
  - Frustration with time and institutional barriers to introduce new policies
  - Lack of understanding of scale & temporal dimensions of diffuse pollution
  - Insufficient attention to establish a more inclusive stakeholder process

Key OECD policy messages toward sustainable water quality (WQ) management in agriculture - 1

- **Use a mix of policy instruments to address water pollution:**
  - Each policy instrument has strengthens/weaknesses
  - Growing interest in using innovative policy tools and market approaches (water quality trading, agro-food chain initiatives)
  - Key focus of many recent initiatives is in changing farmer behaviour
- **Enforce compliance with existing WQ regulations**, (e.g. improving on-farm inspection and imposing penalties more effectively)
- **Remove perverse support in agriculture to improve WQ** (50% of total OECD producer support in 2008-10, provided incentives to produce and/or use inputs, the share was 85% in 1986-88)
- **Take into account the polluter-pays-principle,** but can be difficult with diffuse source agriculture water pollution

Key OECD policy messages toward sustainable water quality (WQ) management in agriculture - 2

- **Set realistic WQ targets for agriculture,** taking into account marginal costs/benefits of adopting a given practice to attain target
- **Improve the spatial targeting of policies**, to areas where water pollution is most acute, but can be difficult if policy measure is voluntary
- **Assess the cost effectiveness of different policy options**, to enable informed discussion about agricultural production/environment trade-offs in achieving water quality benefits
- **Take a holistic approach to agricultural pollution policies** (some policies may lead to environmental conflicts others to co-benefits)
- **Establish information systems**, to support farmers, water managers and policy makers (more information needed for a given policy change of the physical impact, costs, and farmer reaction

Overview of key policy messages to improve the sustainable management of water in agriculture

- **Ensure strong and high level political commitment** to water policy and institutional reforms, and encourage greater cohesion and integration of all stakeholders

- **Overcome policy and institutional legacies** of single issue/industry (agriculture, water, energy, environment) policies to achieve greater policy coherence

- **Consider a mix of policy instruments**, including regulations (control), economic instruments (incentives), information and cooperative approaches (persuasion)

- **Provide support systems** (training, education) for main stakeholders (farmers, water managers, etc), underpinned by robust knowledge, information and monitoring

Visit the OECD websites:

- Agriculture & water: **www.oecd.org/agriculture/water**
- Water general: **www.oecd.org/water**
- Agri-environmental indicators: **www.oecd.org/tad/env/indicators**

Contact: **Kevin.Parris@oecd.org**