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• Sustainability and multifunctionality /ecosystem services
• Policy measures and local actions
• Enhancing values of water and farming: GA and NGA
• Trade implications
• Challenges and conclusions
What we had been doing?

- Globalization, WTO → Economic factors

- concentration and increase in economies of scale
- specialization or monoculture
- intensification with increased use of inputs (high input-high yields)
- marginalization (under utilization) and/or abandonment of farmland
Impacts

- Increased food/rice availability
- Slow down of productivity increase
- Decline of rice harvested area and stock
- Long term declining trend of price
- Environmental degradation and loss of biodiversity and cultural diversity
• Price decline since the early 1980s. After 1998-99, another decline ($800 → <500, <300)
• Import share of rice has been on the rise and production and trade became more market oriented after the late 1980s
Trend of Rice Harvested Area

Decline of rice harvested area between 1999 ->2004 : World 157 -> 154 million ha, Asia 140 ->137, China 32->28, India 45 ->42
Growth rates of yield, area, production with price

<table>
<thead>
<tr>
<th>Growth rate ( % )</th>
<th>Yield</th>
<th>Area</th>
<th>Prod</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>’60s ( 1963-1972 )</td>
<td>2.23</td>
<td>0.9</td>
<td>3.20</td>
<td>0.59</td>
</tr>
<tr>
<td>’70s ( 1973-1982 )</td>
<td>2.74</td>
<td>0.44</td>
<td>3.22</td>
<td>16.5</td>
</tr>
<tr>
<td>’80s ( 1983-1992 )</td>
<td>1.94</td>
<td>0.45</td>
<td>2.39</td>
<td>0.55</td>
</tr>
<tr>
<td>’90s ( 1993-2002 )</td>
<td>0.85</td>
<td>-0.04</td>
<td>0.81</td>
<td>-3.2</td>
</tr>
<tr>
<td>Past 5 years ( 1997-2002 )</td>
<td>0.63</td>
<td>-0.75</td>
<td>-0.15</td>
<td>-8.0</td>
</tr>
</tbody>
</table>

Source: www.irri.org/science/ricestat/ , 3-year moving average

- Growth rates in yield and area increase has been slowing down with decreasing price level.
Production and Consumption of Rice

Gaps of production and consumption widening, leading to the decline of stocks: 99-00 143 million ton → 04-05 73 million ton

Source: USDA, milled rice basis
Sustainable Development is endangered

**Economic**
- Production and Productivity Increase
- Comparative advantage
- Economies of Scale

**Social/Cultural**
- Equity
- Participation
- Empowerment
- Social Mobility
- Cultural Preservation

**Environment**
- Biodiversity
- Natural Resources
- Carrying Capacity
- Ecosystem Integrity
- Clean Air and Water
Understanding of Farming in a wider context

Institutional framework
Economic framework

Policy framework
- Price and food security/trade policy
- Technology and Extension

Infrastructure & management
Quantity, Timing & Quality

Poverty A
Livelihood
- Food
- Security
- Social, Cultural

Farmland area:
Bio-diversity, landscape

Physical system
Basin/IWRM

Water
ET
Gas

Rainfall

Production

Outflow (nutrients, chemicals, soil)
→ Surface, Groundwater

Farming practices/
Chemicals, Plowing…
Rice Farming System

• More intensive interactions with
  – Water (water consumption at field level, reuse or recharge, water regulation, water cycle, )
  – Material (fixation of nitrogen, absorption of nutrients)
  – Society (Communal farming, participation for management)
  – Environment (bio-diversity richness, landscape, temperature cooling effects, emission of methane or global warming gas)
Discussions on Multifunctionality/ Ecosystem Services

• Multifunctionality
  – OECD (1998)
  – ICID Workshops (2000-2005)
  – WWF-3 Kyoto
  – PAWEES (2003 establishment : Seminars and Workshops)
  – INWEPF (2003 establishment: Conferences)

• Ecosystem Services (Millennium Ecosystem Assessment 2003)

• Dialogue -> Comprehensive Assessments
  – CGIAR and other stakeholders
ICID Workshop Summary (2005)

- Pro-poor low cost technology and investment options of water with less impact on environment.
- Integration of modern technology/science and traditional knowledge/wisdom and cultural heritage
- More research and data needed (complex interactions, quantification and valuing, regional/local characters, special and seasonal variations.)
- Multiple uses of water should be promoted to enhance overall productive benefits. Promotion of and support for Eco-friendly farming practices and uses/management of water.
- Mind shifts of general public and policy makers to focus more on eco-agriculture perspective (PR&marketing)
Valuing Multifunctional Roles

Comparison of multifunctional values in different countries

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Flood Control (Bill US$)</td>
<td>32.70</td>
<td>12.36</td>
<td>0.40</td>
</tr>
<tr>
<td>Water Resources Cons. (Bill US$)</td>
<td>14.18</td>
<td>1.52</td>
<td>0.52</td>
</tr>
<tr>
<td>Soil Conservation (Bill US$)</td>
<td>7.57</td>
<td>0.20</td>
<td>0.45</td>
</tr>
<tr>
<td>Land Subsidence (Bill US$)</td>
<td>0.00</td>
<td>0.00</td>
<td>1.80</td>
</tr>
<tr>
<td>Water Purification (Bill US$)</td>
<td>0.00</td>
<td>2.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Climate Mitigation (Bill US$)</td>
<td>1.58</td>
<td>1.91</td>
<td>1.17</td>
</tr>
<tr>
<td>Landscape and recreation (Bill US$)</td>
<td>22.20</td>
<td>0.00</td>
<td>1.02</td>
</tr>
<tr>
<td><strong>Total (Bill US$)</strong></td>
<td><strong>78.23</strong></td>
<td><strong>18.08</strong></td>
<td><strong>5.36</strong></td>
</tr>
<tr>
<td>Paddy land area (1000 ha)</td>
<td>1700</td>
<td>1146</td>
<td>332</td>
</tr>
<tr>
<td>Rice Production (Bill US$)</td>
<td>20.74</td>
<td>12.68</td>
<td>1.10</td>
</tr>
<tr>
<td>Multifunctional Value/ ha (US$)</td>
<td>46016</td>
<td>15775</td>
<td>16146</td>
</tr>
<tr>
<td>Rice Production/ ha (US$)</td>
<td>12203</td>
<td>11062</td>
<td>3297</td>
</tr>
<tr>
<td><strong>Multifunction / Production Ratio</strong></td>
<td><strong>3.77</strong></td>
<td><strong>1.43</strong></td>
<td><strong>4.90</strong></td>
</tr>
</tbody>
</table>

Source: AERC 2004
Enhancement of overall values

- **Economic, environmental, social values**
  - Increase economic values (productivity, multiple uses)
  - Environmental values (adoption of eco-friendly farming/infrastructure provision) ↔ tradeoff with productivity?
  - Social values (awareness raising)

- **Assessment of interactions among three values** (CA by IWMI) → Quantification and valuation

- **Identify Appropriate intervention measures**
  - Governmental intervention
  - Non-governmental intervention
Adoption of Agri-environmental measures in OECD countries

- EU: Agri-environmental measures ESA, LFA, AEM (environment payment for good farming practices: code of practices)
- Regulations and compliance
- >1/3 of Rural development on AEM (average 2000-2002).
- AEM in total agricultural area: 15% in 1998 to 27% in 2001
US

- **Conservation and Compliance**
  - Sodbuster,
  - Swampbuster
  - Conservation Reserve Program.
  - The Water Quality Incentives Program (1990 WQIP)
  - The Environmental Quality Incentives Program (EQIP) in 1996

- **The Farm Security and Rural Investment Act of 2002**
  - land retirement and land conservation schemes,
  - cross compliance, and
  - technical assistance in an integral manner.
  - Conservation Reserve Program (CRP): rental payments for land retirement (covers 10% of the cropland)
  - EQIP focuses on soil and water management (1-10 year contracts)
  - Evaluation by established indicator is carried out.
Farmers to manage and maintain local resources
Declining management capacity

Participation to cooperative works in rural community: declining
Agricultural policy framework (Japan)

- Difficulties of maintaining local resources by farmers alone → abandoning of cultivation → loss of ecosystem services
- Intensification of cultivation → Negative impacts on environment (pollution, loss of bio-diversity)
Legislative framework for Agri-environmental measures

• Revision of the Land Improvement Law (2001): more attention to environment,
• Follow “Rural Environment Improvement Master Plan” established by local governments (2003) for projects
• the Nature Restoration Law in 2002
• the Landscape Preservation Law (2004)
# Direct payment to better farming practices (2003)

Agri-environment measure by Shiga prefecture

<table>
<thead>
<tr>
<th>Chemical reduction</th>
<th>&gt;=50%</th>
<th>&gt;70%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>up to 3 ha</td>
<td>50,000</td>
<td>+10,000</td>
</tr>
<tr>
<td>above 3 ha</td>
<td>25,000</td>
<td>+ 5,000</td>
</tr>
<tr>
<td>Vegetable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green H</td>
<td>300,000</td>
<td>+60,000</td>
</tr>
<tr>
<td>Open Field</td>
<td>50,000</td>
<td>+10,000</td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>grape, peach, etc</td>
<td>300,000</td>
<td>+60,000</td>
</tr>
<tr>
<td>plum, persimmon, etc</td>
<td>100,000</td>
<td>+20,000</td>
</tr>
<tr>
<td>Tea</td>
<td>100,000</td>
<td>+20,000</td>
</tr>
<tr>
<td>Rape seed</td>
<td>20,000</td>
<td>-</td>
</tr>
</tbody>
</table>

(Yen/ha)
Evaluation and payments

• “Willingness to Pay” (WTP) of the household 1,413.8 yen per year.

• Total annual benefit: 6116 million yen, with the 473 thousands households and 91.5% of the rate of WTP.

• The area under this measure
  – 394 ha in 2001 to 4,265 ha in 2005. (increasing)
  – Actual payment reached to 120 million yen in 2004 and budgeted payment of 2001 million yen in 2005.
Policy Interventions

• Policy Goals: Economy & Livelihood, Security, Social, Environment, Cultural … \(\leftarrow\) Multiple objectives, Values & Weights \(\leftarrow\) Public consensus

• Policy measures: Regulations, Market, Trade, R&D, Infrastructure \(\leftarrow\) Best mix

• Alternative land uses \(\leftarrow\) Agriculture, Wetland, Forestland, Commercial/Residential, Industrial

• Farming: Intensive or LISA/organic : farming \(\leftarrow\) good farming practice (environmental benefits)
Non-governmental approaches (NGA)

- Difficulty of direct government support
  - WTO regulation, financial difficulty
- Rising awareness of local people on the importance of farming (paddy field) and water system

Adoption of NGA by NGOs, NPOs, CSs to support the provision of ecosystem services (Non commodity outputs)

Midori Net (Local actions)

- Midori Net = Green Network
  - 水土里 (Network of Water, Land and Rural Community)
- 21st Century LID Renaissance Movement: Farmer organization → local community
- Local initiative and local actions
  - Multiple uses (hydropower generation, fish pond, golf driving range, tourism, fire prevention, Farm stay, tourism, etc)
  - Historical heritage, festivals
  - Involvement of local residents into maintenance
  - Environment education utilizing paddy fields and water use facilities
  - Landscape preservation, amenity

Source: www.inakajin.or.jp/21jireiff.html
Multiple uses

Regulating reservoir for fishing pond: 40,000 people visit/year
Regulating reservoir for Golf driving range: reduction of O&M cost
Historical heritage and Culture

- Oldest Irrigation Pond: Manno (15 million m³)
- Over 1,300 years and still in use
- Over 1,200 years tradition
Landscape preservation and biodiversity

- Cherry blossom in spring, and fireflies in summer
Amenity canal and park: fireflies

- Environment conservation and tourism resource
Participation of local residents in management

• Agricultural water as “local water” for fire prevention, living, and environment.
Environment education

• Rice transplanting experience
# Trade and multifunctionality

- WTO: Green box: Decoupling
- Agri-environmental measures → Production implications (Recoupling?) ← Conformity to WTO rules
- Food security/ right to produce
- International Treaties & Initiatives
  - MDG
  - Kyoto Protocol: Climate Change → CDM
  - the Ramsar Convention: Wetland
  - the Convention on Biological Diversity.
  - UNESCO Cultural Heritage
- Fair trade (poverty implications) and slow food movement
World Cultural Heritage by UNESCO

Dujiangyan Weir in China     Ifugao terraced rice fields, Philippines
From virtual water to virtual environment?

- Total benefits and costs of farming and water use
  - Economic benefits of rice production
  - Environmental benefits (flood protection, climate, water purification, groundwater recharge, biodiversity, erosion control, landscape)
  - Social benefits (employment generation, rural development, food security)
  - Cultural benefits (festivals, traditions, identity)
  - Economic cost (opportunity cost of using water)
  - Environmental costs (water pollution, methane gas emission, salinization)
  - Social costs (potential health hazards or water borne disease).
  - Transportation associated costs
Conclusions

• **Assessment of interactions** among economic, environmental, social, cultural elements. Quantification and Valuation of benefits and Costs

• Identification of **Effective Intervention Measures** for enhancing overall benefits: Multiple uses, Environment friendly farming
  – Government (direct supports, institutional, legislative)
  – Non-government (National trust, Civil societies, WUAs)
  – Combination

• **Different trade mechanism**: Trade: Based on the comparison of overall benefits and costs of production in exporting countries and importing countries plus overall costs associated with transportation

• **Awareness raising**: General public, policy- and decision-makers