Adoption and Impact of the Alternate Wetting and Drying (AWD) Water Management Technique for Irrigated Rice in the Philippines

Rod M. Rejesus (NC State/IRRI)
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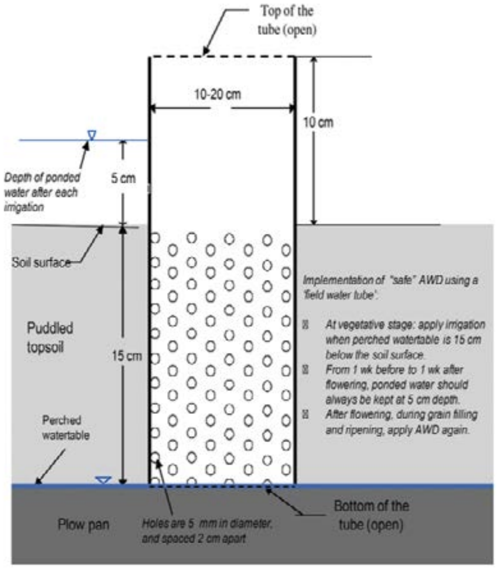
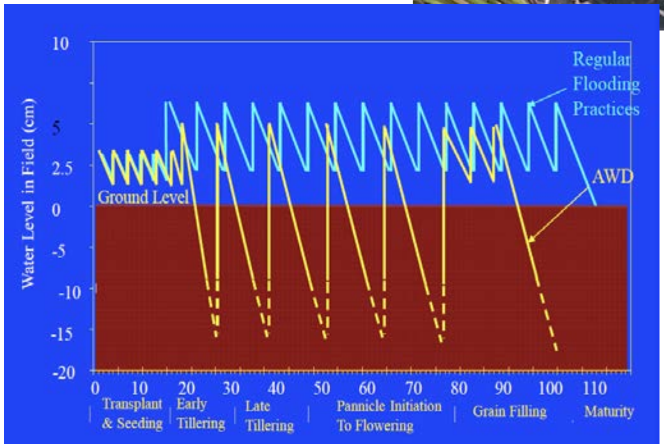
Introduction

- Increasing water scarcity in Asia
- 1kg of rice typically requires 3000-5000 liters of water
- Need more efficient water management technologies

AWD Water Management





- Instead of continuous flooding, rice fields are allowed to dry intermittently in AWD
- Field water tube is used to reveal perched water table
  - Irrigate to 5cm whenever water level in the observation well is below 15cm below soil surface (dry season)

Research Question

- To comprehensively and rigorously examine the multi-dimensional impact of AWD in the Philippines
  - Micro-level Economic Impact
  - Poverty Impact
  - Socio-cultural Impact
  - Environmental Impact
  - Rate-of-returns on research investments
    - Adoption levels

Impact Pathway

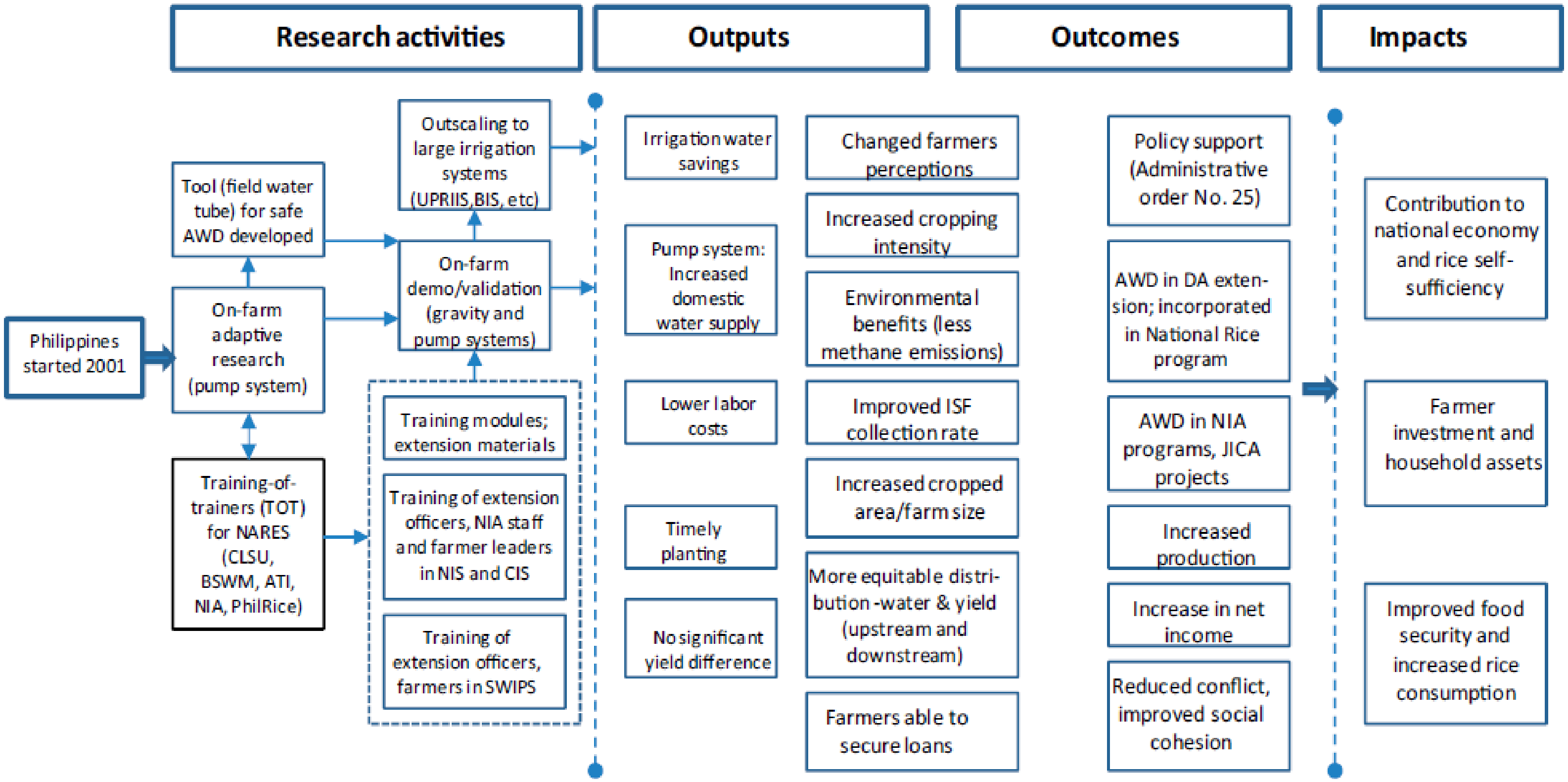


Fig. 3. Impact pathway for AWD adoption in the Philippines.

Source: Lampayan et al. (2015)

Irrigation and Institutional Context

- Focus on large gravity-based, national irrigation systems (NIS)
- NIS – constructed and jointly operated by National Irrigation Association (NIA) and farmer Irrigator's Associations (IAs)
  - Sub-groups: Turnout Service Area Groups (TSAGs)

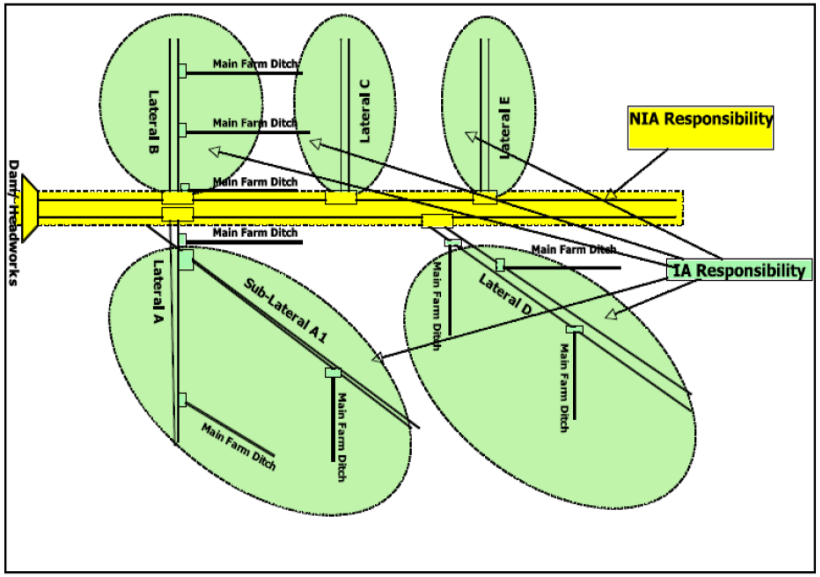
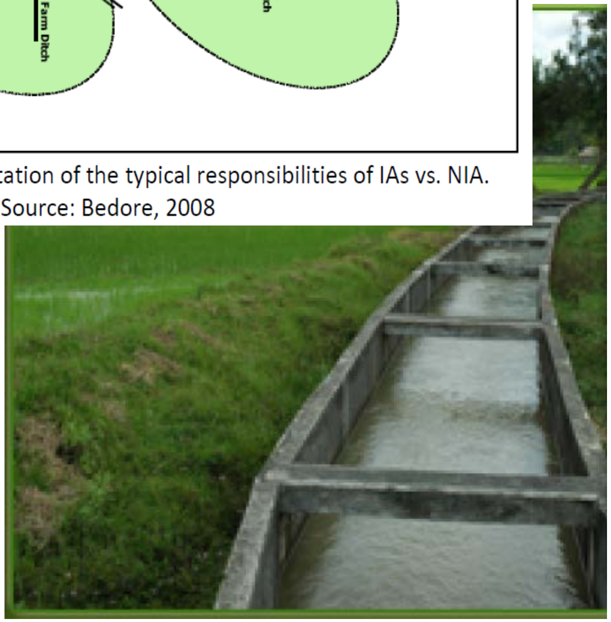
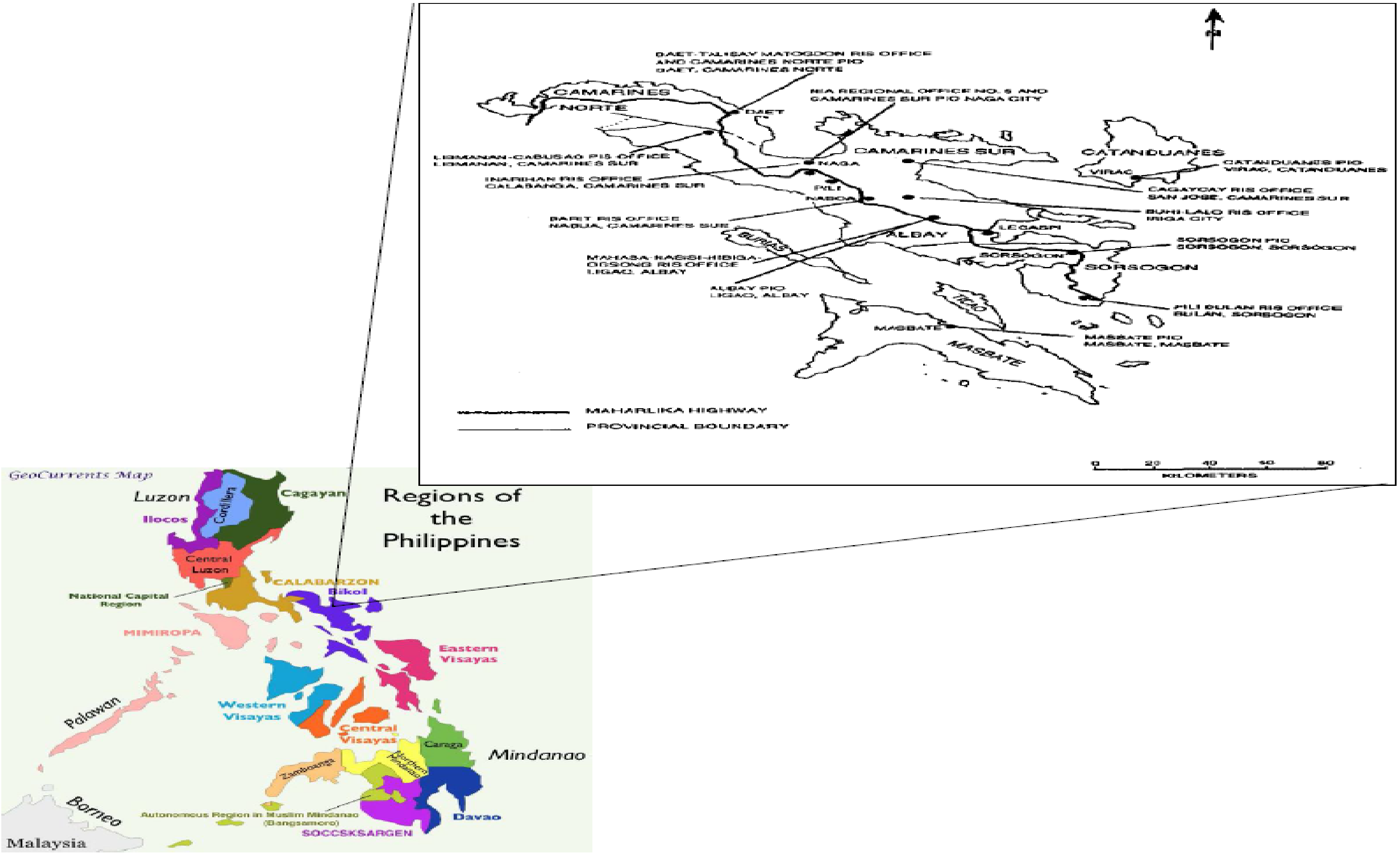


Figure 1. Pictorial representation of the typical responsibilities of IAs vs. NIA.
Source: Bedore, 2008



Main Study Area: Bicol Region



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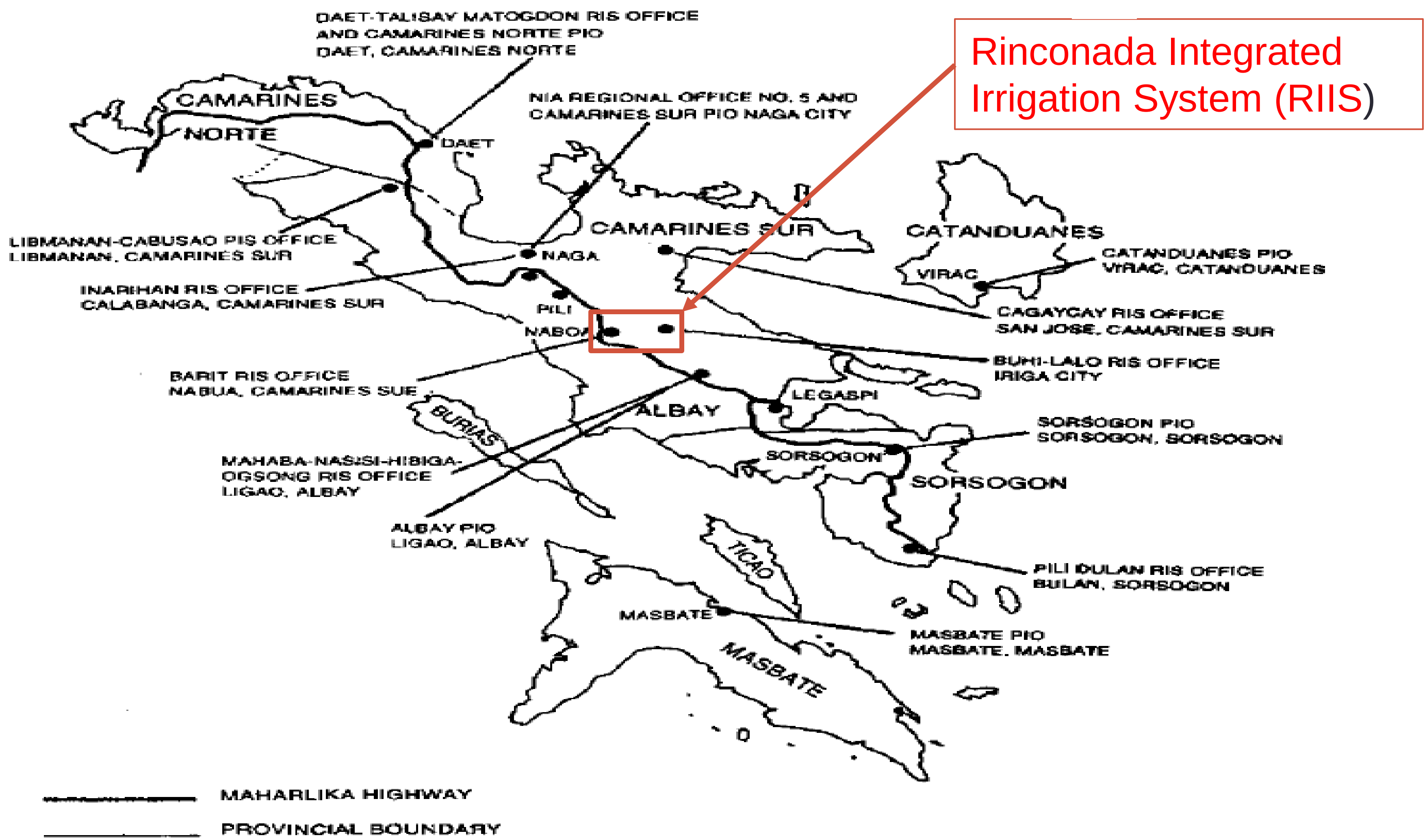


Focus System: RIIS

- Rinconada Integrated Irrigation System (RIIS)
- Largest irrigation system in Bicol region

No. of IAs	No. of TSAGs	Area (ha)	No. of Farmers
34	**280**	**7,031**	**16,391**

As of Dec. 2013

Micro-Level Economic Impact

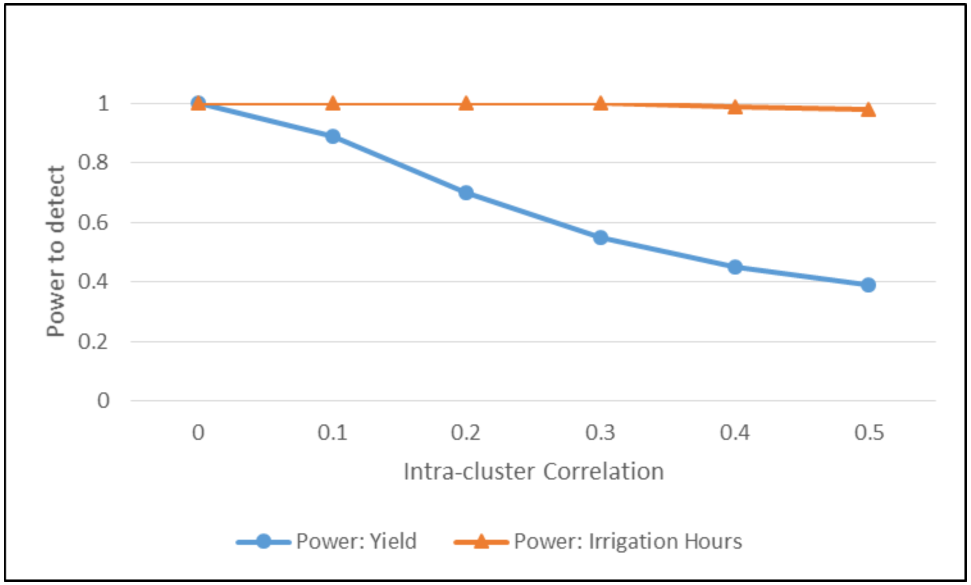
- Randomized Control Trial (RCT) approach with baseline data collection prior to treatment
- Stratified "cluster" randomization approach at the TSAG level

Nine Stratification "Groups"		
Upstream IA, Upstream TSAG	Midstream IA, Upstream TSAG	Downstream IA, Upstream TSAG
Upstream IA, Midstream TSAG	Midstream IA, Midstream TSAG	Downstream IA, Midstream TSAG
Upstream IA, Downstream TSAG	Midstream IA, Downstream TSAG	Downstream IA, Downstream TSAG

Micro-Level Economic Impact

- Within each stratification "group", randomly select 2 AWD treated TSAGs and 2 control TSAGs
  - Total of 36 TSAGs in the study (4 selected TSAGs x 9 stratification groups); 18 treated and 18 control TSAGs
- For each of the selected TSAG, randomly sample 20 farmers (total of 720 farmers, 360 treated and 360 control)
- Possible refinement:
  - Randomly select treatment and control TSAGs proportional to size (i.e., hectares or no. of farmers)?
- Data collection: Dry Season 2016 and 2017

Micro-Level Economic Impact



Power calculations for detecting differences in yield and irrigation hours (under various intra-cluster correlation assumptions)

Micro-Level Economic Impact

- Micro-level Impact Indicators:

Type of Impact:	Method	Impact Indicators/Measures
Micro-Level Economic Impact	RCT Approach with baseline data collection	Yield Impact (ton/ha or kg/ha)
		Net farm Income Impact (Pesos/ha or $/ha)
		Water use Impact (irrigation hours or water volume in m^3)
		Labor use Impact (man-days/ha)
		Pesticide use impact (kg/ha)
		Fertilizer use impact (kg/ha)
		Area Farmed (ha)

- Heterogeneity of Impacts
  - Upstream vs. Midstream vs. Downstream
  - Gender differentiated (by male or female head)

Poverty Impact

- We proposed to use the Foster-Greer-Thorbecke (FGT) approach
- Impact Indicator:

Type of Impact:	Method	Impact Indicators/Measures
Poverty Impact	FGT approach	Difference in the FGT Poverty Index for the AWD treated group versus the control group

- Based on observed income differential from RCT
  - Simplistic, indirect price effects not considered
  - Consider looking at poverty maps over time?

Socio-Cultural Impact

- Primarily qualitative:
  - KIIs and FGDs (i.e., from visits with NIA regional offices)
  - Network Analysis and Contribution Analysis
- Impact Indicators:

Type of Impact:	Method	Impact Indicators/Measures
Socio-Cultural Impact	FGD & KII	Reduction in no. of water-related conflicts (i.e., water grabbing incidents)
		Perceptions of private sector on water availability (i.e, KII of hydroelectric plant personnel)
	Network Analysis	Social network map (at IA and system level)
		Prestige scores and centrality measures (i.e., degree centrality and Bonacich centrality)
	Contribution Analysis	Impact attribution based on a constructed theory change and evidence from observed outcomes

  - Issue: how relevant is network analysis in AWD?

Environmental Impact

- Methane Reduction Analysis using Clean Development Mechanism (CDM) formulas (i.e., CH_4, CO_2e reduction)
  - Value tons of CO_2e reduction (from carbon markets?)
- Watershed Scale Analysis to measure water savings at higher spatial scales
  - Utilize a remote sensing approach by Hafeez (2002)
- Impact Indicators:

Type of Impact:	Method	Impact Indicators/Measures
Environmental Impact	CDM approach	Methane emission effect (kgCH_4/ha/season)
		Equivalent Global Warming effect (tCO_2e/year) and $ value
	Watershed Scale Analysis	Watershed scale water volume (m^3)
		Watershed scale water productivity measure (kg of crop yield per m^3 water delivered)

AWD Adoption & Rate-of-Returns

- Adoption numbers based on data to be collected from visits of all NIA Regional Offices in the Philippines
  - Proposed to use Diagne and Demont (2007) approach
  - Synergy with remote sensing SPIA proposal to measure adoption
- Use Alston et al (1998) framework to estimate rate-of-returns on research investments

Type of Impact:	Method	Impact Indicators/Measures
5. Rate-of-returns on research investments	Economic Surplus Analysis	Net Present Value (NPV in $), benefit-cost-ratio (BCR), and Internal rate of return (IRR)

Synergies with Parallel Studies

- Submitted SPIA proposal to track adoption of AWD through remote sensing approaches
- IRRI-AWD projects: Irrigated Rice Research Consortium (IRRC), Closing Rice Yield Gaps in Asia Project (CORIGAP)
- DA Philippines' Food Staple Self Sufficiency Program (FSSP)

Work Plan

Main activities	2016												2017											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Preparation of survey instruments and initial Bicol region visits																								
Randomization, baseline data collection, and encoding																								
NIA region visits and adoption estimation																								
AWD training in in treatment TSAGs																								
Implementation of AWD in treatment TSAGs																								
CDM emission study and watershed-scale analysis																								
After-treatment follow-up data collection and encoding																								
FGDs/KIIs, network analysis and contribution analysis																								
Micro-level economic impact, poverty impact & rate-of-return analysis																								
Report/article writing																								

Project Team

- Rod M. Rejesus (NC State/IRRI)
- Sam Mohanty (IRRI)
- Grant Singleton (IRRI/IRRC/CORIGAP)
- Jose M. Yorobe Jr. (UPLB/IRRI)
- Ruben Lampayan (IRRI)
- Ole Sander (IRRI)
- Evangeline Sibayan (PhilRice)
- Vic Vicmundo (NIA Bicol)
- Rose San Valentin (IRRI)

Issues and Challenges

- Randomly select proportional to size or not?
- Power of RCT for yield - increase no. of TSAGs?
- Gender differentiated impacts acceptable?
- Alternatives to FGT approach to poverty impact?
- Is network analysis relevant?
- Do we need rate-of-returns on research?
- Too many proposed analysis, too little time? Scale-back?

THANK YOU!

- Other questions, comments, suggestions or further discussion?