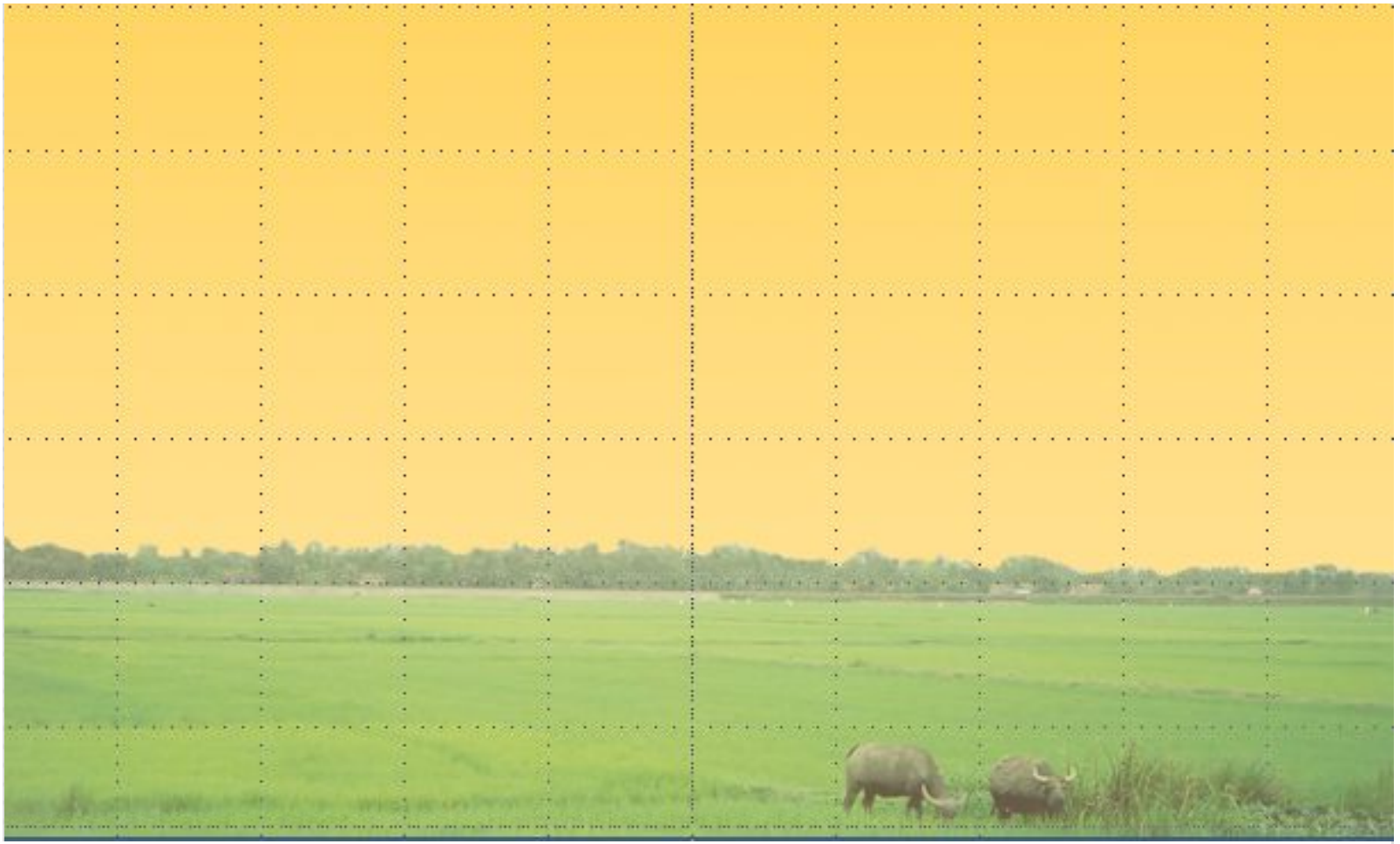

DESIGNING IWRM FRAMEWORKS FOR SUSTAINABLE FOOD PRODUCTION IN TROPICAL REGIONS

- Indonesia: Budi I. Setiawan, Agnes Rampisela, I Wayan Budiasa, Satyanto K. Saptomo, Chusnul Arief, Fadli Irsyad, Sutoyo, Suhardi Darusi
- Japan: Tsugihiro Watanabe, Masakazu Mizutani, Haruya Kagami, Kenichi Nakagami, Takao Nakagiri

PURPOSES

- To give inputs and recommendations to any concerned parties on how to achieve sustainable food production through applying sound integrated approach of water resource management.
- To formulate multidimensional aspects and their interactions contributing to the integrated water resource management for sustainable food production.
- To introduce water saving, high yield, organic SRI Technology.

SRI Paddy compared to the conventional paddy

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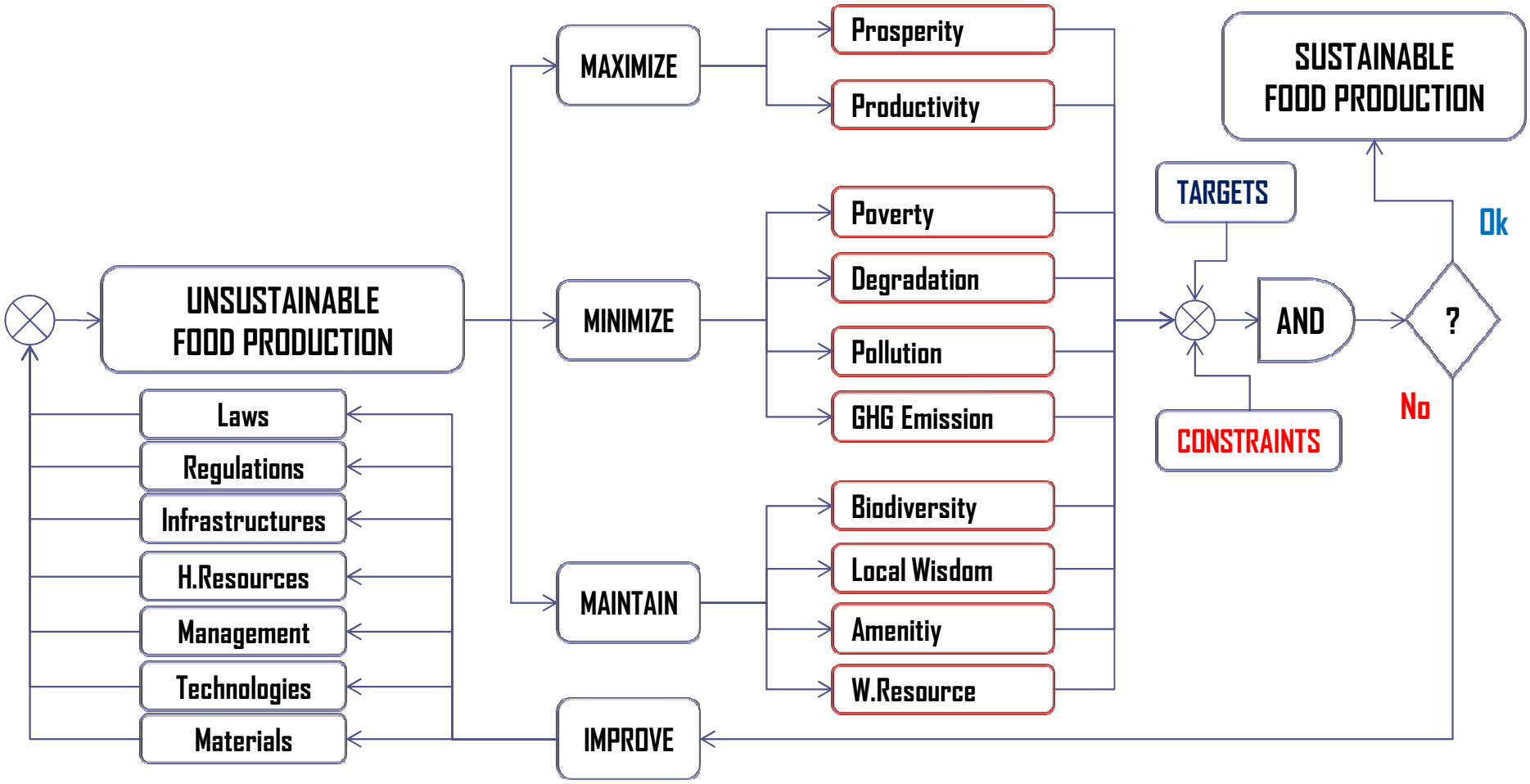
SRI Paddy more resisting to unexpected circumtances

Miyatty Jannah
Crawuk, Ngawi

BP HOPPER and BAD WEATHER

http://budindra.staff.ipb.ac.id

SELARAS PRINCIPLE FOR SUSTAINABLE FOOD PRODUCTION



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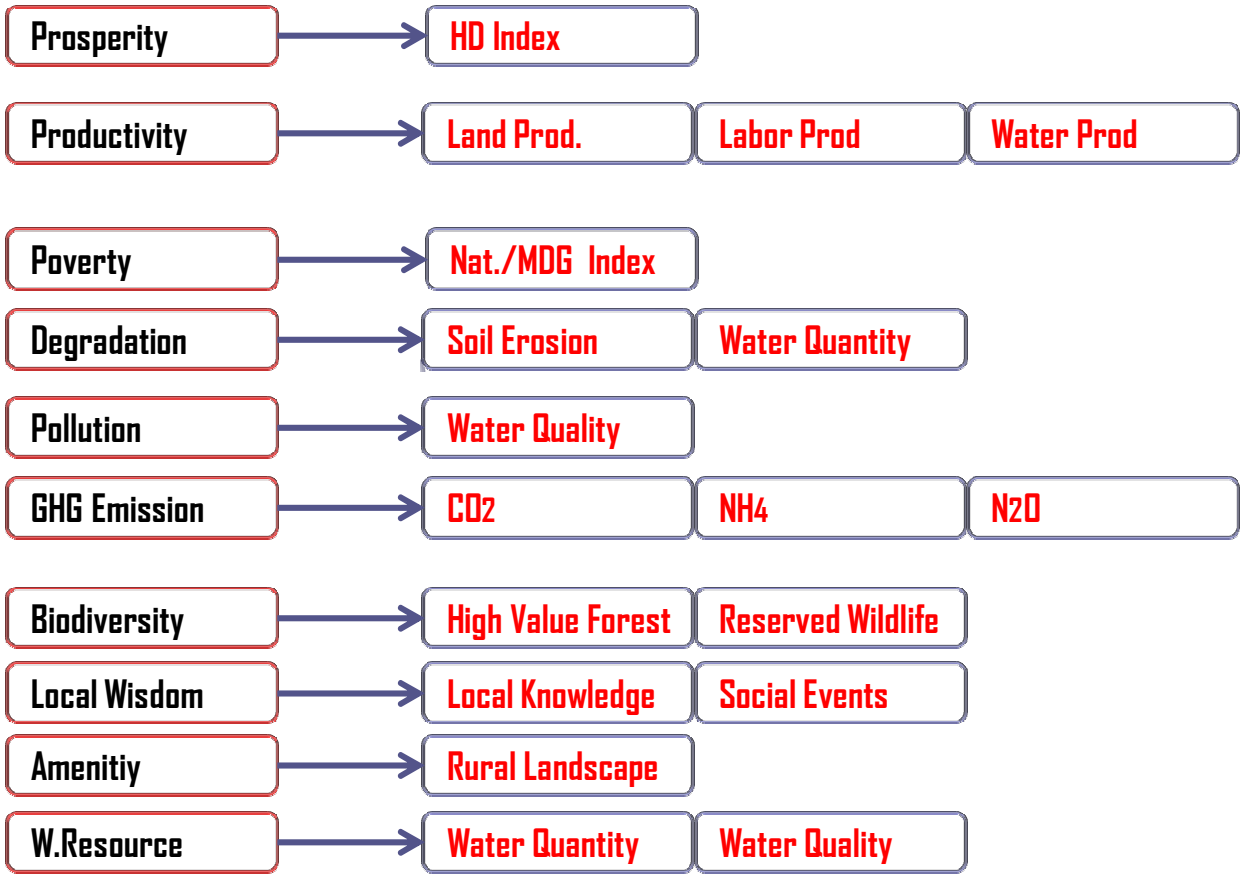
3MI=Maximize, Minimize, Maintain, and Improve

FOCUSED VARIABLES & INDICATORS



SELECTED SITES

- BASINS
  1. Jeneberang Watershed (New Irrigation System)
  2. Saba Watershed (Established Irrigation System)
- FARM LANDS
  1. Tertiary Paddy Fields.
  2. Uplands.
  3. Settlements.

SABA BASIN BALI

Name	Description	Position	Altitude
129	View Point Above Lake Tamblingan 06-06-11 10:05:26AM	S8 14.200 E115 07.978	1350 m
130	Upstream Upland Field 06-06-11 10:15:15AM	S8 14.698 E115 06.095	1331 m
132	Distructed Bridge 06-06-11 11:26:50AM	S8 16.328 E114 57.978	258 m
133	Flood Destructed Dam at Watu Magaang 06-06-11 12:02:06PM	S8 16.551 E114 57.868	247 m
135	Flood destructed Water Division Gate 06-06-11 2:49:26PM	S8 11.153 E115 07.168	381 m
137	Saranam 06-06-11 4:19:50PM	S8 20.194 E115 11.220	819 m
138	Hotel 06-06-11 6:33:12PM	S8 40.472 E115 15.615	35 m

JENEBERANG BASIN SOUTH-SULAWESI

Name	Description	Position	Altitude
144	08-06-11 8:03:38AM	S5 10.793 E119 27.899	21 m
145	08-06-11 8:46:28AM	S5 16.602 E119 34.815	121 m
146	Biblibili Dam and Reservoir 08-06-11 8:47:09AM	S5 16.667 E119 34.924	123 m
147	Bilibili Weir 08-06-11 10:02:57AM	S5 16.987 E119 34.836	59 m
148	Bissua Weir 08-06-11 10:31:32AM	S5 18.239 E119 31.977	42 m
149	Irrigation intake from Bissua Weir 08-06-11 10:43:05AM	S5 18.154 E119 31.715	44 m
150	Kampili Weir 08-06-11 11:03:47AM	S5 16.655 E119 30.770	34 m
152	Taman Cerdas PELANGI 08-06-11 1:12:02PM	S5 18.588 E119 25.044	20 m
153	T1 (Tertiary box) 08-06-11 2:44:23PM	S5 18.546 E119 25.077	5 m
154	Secondary canal supplying T1 08-06-11 2:45:54PM	S5 18.560 E119 25.103	7 m
155	T4 08-06-11 2:55:51PM	S5 18.712 E119 24.831	9 m
156	Used water drainage from T3, reused by farmer 08-06-11 3:13:13PM	S5 18.473 E119 24.471	10 m
157	Silangan saluran primer Kampili dan Bossua 08-06-11 3:45:24PM	S5 19.117 E119 26.220	16 m

OBJECTIVES

1. To figure out hystorical, present and future trend of LUCC in the studied areas.
2. To identify significant problems and their driving forces in the studied areas contributing to LUCC.
3. To make clear waterflow regimes and the existing water management in the studied areas.
4. To deliver frameworks for intregrated water resource management in the studied areas.

THEORETICAL APPROACHES

PRODUCTION FUNCTION (Multi inputs):

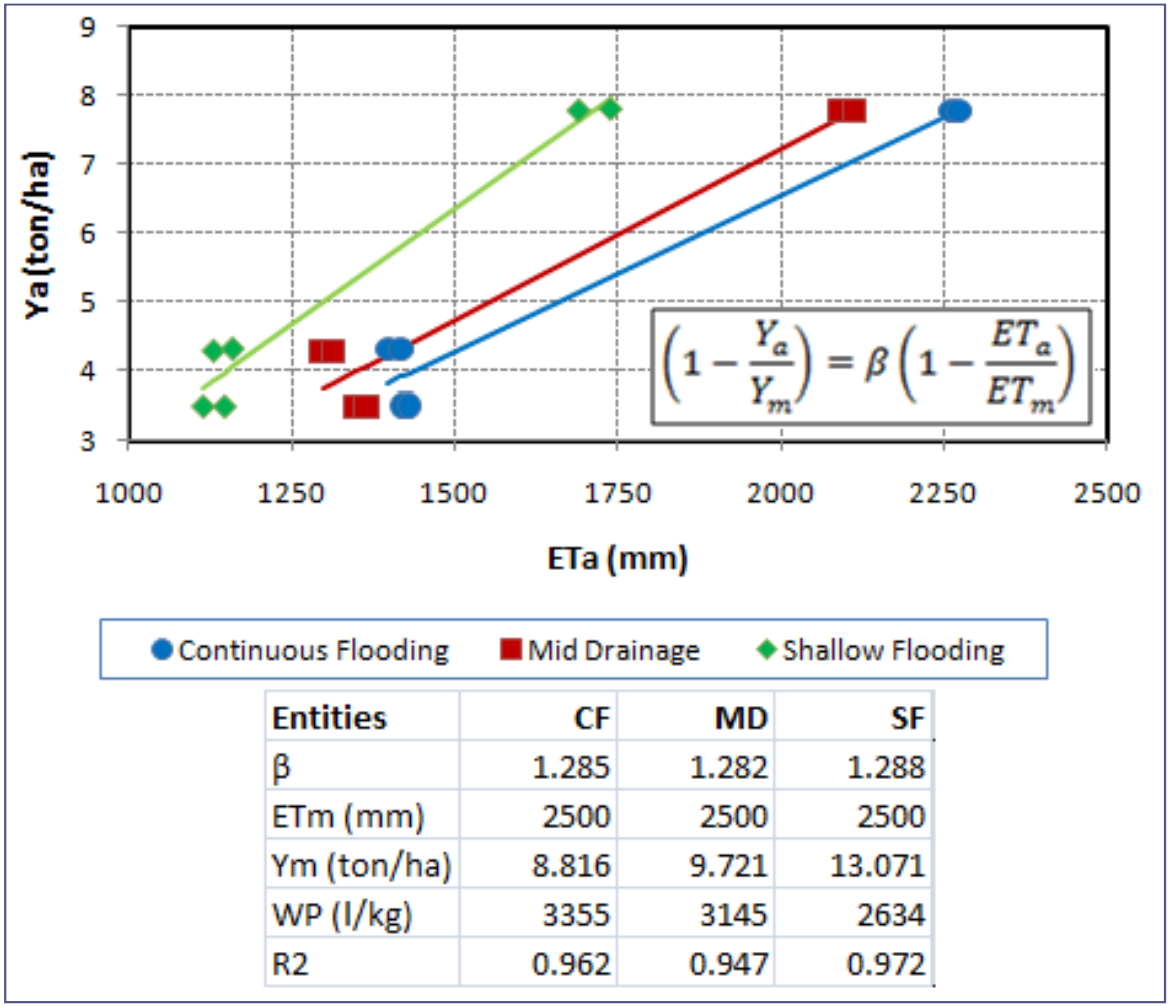
- Ya=f(S, F, L, W)
  - Ya: Actual Yield (kg/ha).
  - S: Seed (kg/ha).
  - F: Fertilizers (kg/ha).
  - L: Labor (md/ha).
  - W: Consumptive Use of Water (m3/ha).
- Altenative Equations:
  - Cobb & Douglas Model (CDM)
  - Artificial Neural Networks (ANN)

THEORETICAL APPROACHES

PRODUCTION FUNCTION:

- $(1-Ya/Ym)=\beta(1-ETa/ETm)$
  - Ya & Ym: Actual and Maximal Yields (mm).
  - ETa & ETm: Actual & Maximum ET (mm).
  - β: Water Yield Sensitivity Coefficient.

PROPER WM INFLUENCED YIELDS



Entities	CF	MD	SF
β	1.285	1.282	1.288
ETm (mm)	2500	2500	2500
Ym (ton/ha)	8.816	9.721	13.071
WP (l/kg)	3355	3145	2634
R2	0.962	0.947	0.972

THEORETICAL APPROACHES

WATER BALANCE EQUATION:

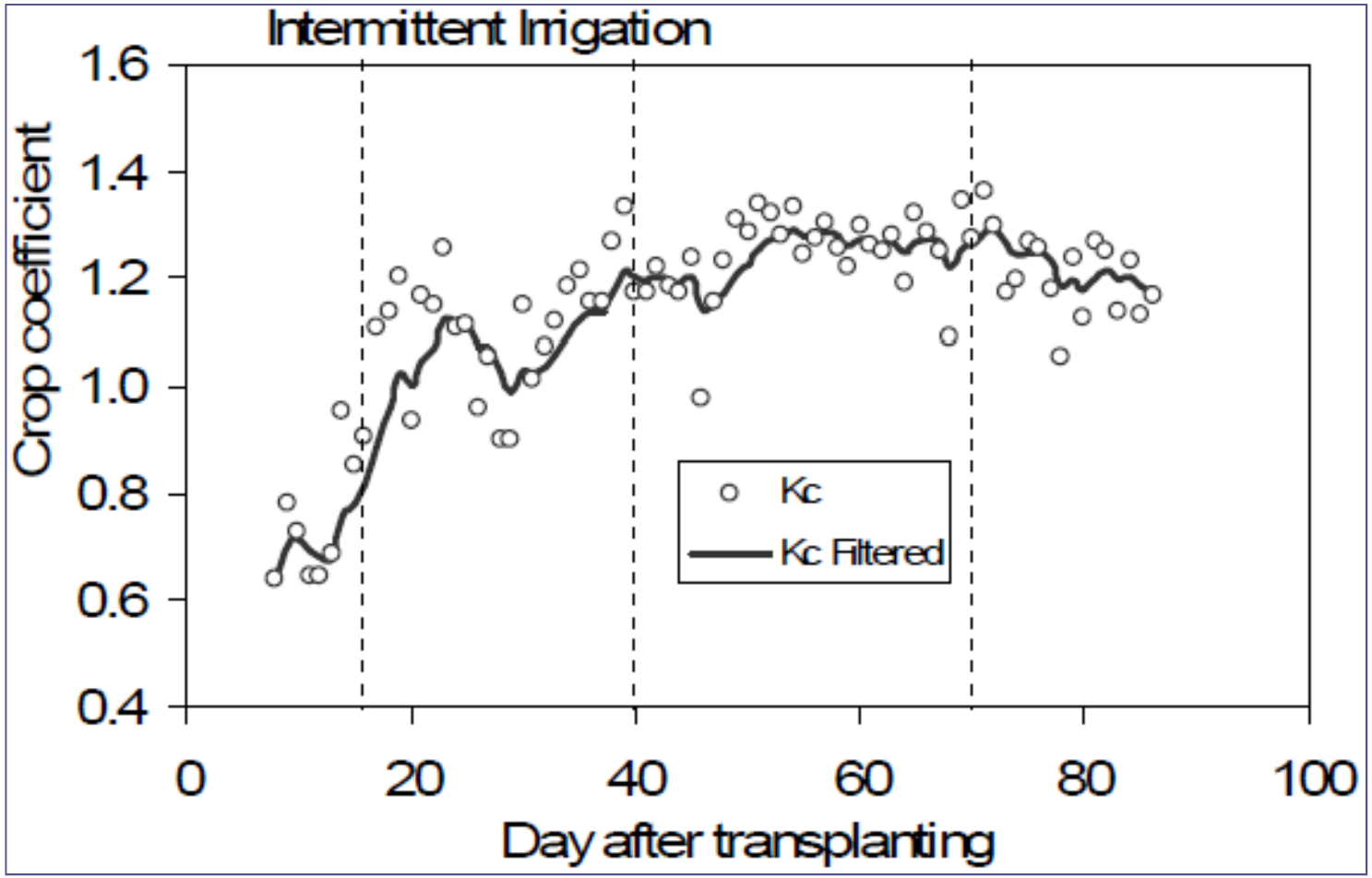
- $\Delta S=(R+GW+IR)-(RO+DP+ETa)$
  - ΔS: Change of water storage (mm/d)
  - R: Rainfall (mm/d)
  - GW: Groundwater (mm/d)
  - IR: Irrigation water (mm/d)
  - RO: Runoff (mm/d)
  - DP: Deep Percolation (mm/d)
  - ETa: Actual ET (mm/d)

THEORETICAL APPROACHES

CROP COEFFICIENT:

- ETa=Kc ETp
  - ETp: Potential ET (mm/d)
  - Kc: Crop Coefficient
- ETp is obtained by:
  - Direct measurement.
  - ET Models (Penmann-Monteith/Hargraeves).

TEMPORAL CROP COEFFICIENTS



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METHODOLOGIES

- Hydrologic Studies:
  - Mapping with GIS
  - Soil and Water Assesment Tools (SWAT).
  - Field Surveys
- Economic and Social Studies:
  - Field Surveys
  - Rapid Rural Appraisal (RRA)
  - Participatory Rural Appraisal (PRA)
  - Optimizing (LP)
  - Descriptive Analysis.

METHODOLOGIES

- Legal and Instutitional Studies:
  - Participatory Rural Appraisal (PRA).
  - Deep Interview.
  - Descriptive Analysis.

STAGES

- 1st YEAR 2011/2012:
  - Mapping.
  - Collecting secondary data.
  - Installing Instuments and collecting primary data.
  - Establishing database and Information System.
- 2nd YEAR 2012/2013:
  - Surveys
  - Data analysis
  - Identifying problems and driving forces
  - Trend analysis

STAGES

- 3rd YEAR 2013/2014:
  - Surveys and data collection
  - Focused analysis on significant problems.
- 4th YEAR 2014/2015:
  - Surveys and data collection
  - Simulating scenarios for improvement
- 5th YEAR 2015/2016:
  - Research synthesis
  - Designing frameworks

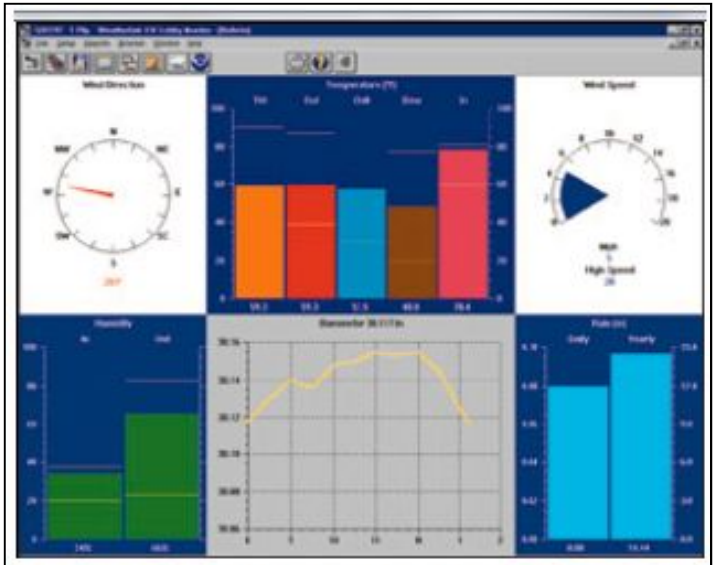
INSTRUMENTATION

- BASIN SCALE
  - Climate Variables with DAVIS Vantage Pro 2 Plus
- FARMLANDS
  - Soil Moisture, Temp, EC and Suction with DECAGON Instruments
- WATER INLETS & OUTLETS
  - Water Level & EC with GLOBAL WATER Instruments.
- FIELD ROUTER for data collection & GSM Transmission to a remote SERVER.

DAVIS Vantage Pro 2 Plus

Davis Wireless Vantage Pro2 Plus and Standard Radiation Shield
$1320.00

Mounting Tripod **$176.00**

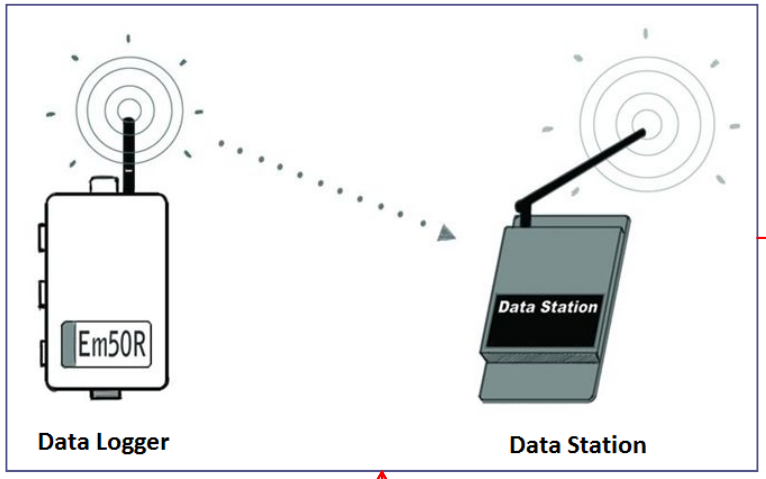


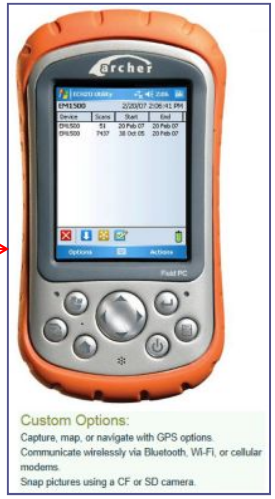
Model: 6510USB **WeatherLink® for Vantage Pro2™, Vantage Vue™, Windows, USB**
$220.00

http://shop.davisnet.com.au/

Unit 12/124 Ham Street,
South Windsor,
NSW, 2756, AU
Phone: 02 4577 6269
Fax: 02 4577 4346

DECAGON INSTRUMENTS





GLOBAL WATER INSTRUMENTS

WL400 WATER LEVEL SENSOR

Submersible Pressure Transducer for Level & Pressure

WQ-COND CONDUCTIVITY SENSORS

Conductivity sensors and conductivity recorder to measure water conductivity.

GL500-2-1 DATALOGGER

Dataloggers and recorders with USB connections

Global Water

In the US, call toll free: **1-800-876-1172**
International phone: 1-979-690-5560
Fax: 1-979-690-0440
E-mail: Globalw*globalw.com

WL400	Water Level Sensor	$586
WQ-Cond	Conductivity Sensor	$755
GL500-2-1	Datalogger	$347

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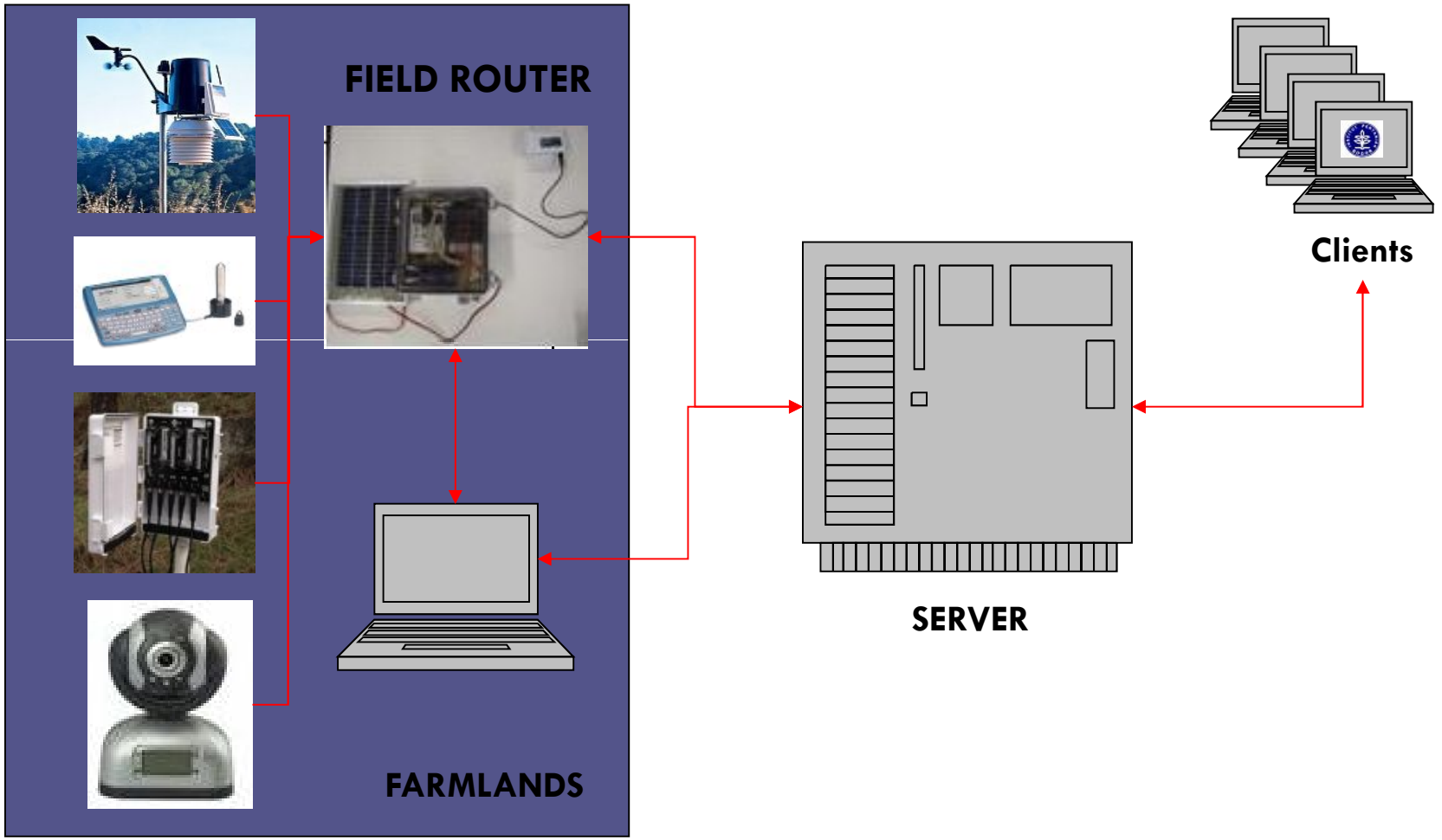
MEASUREMENT SYSTEM



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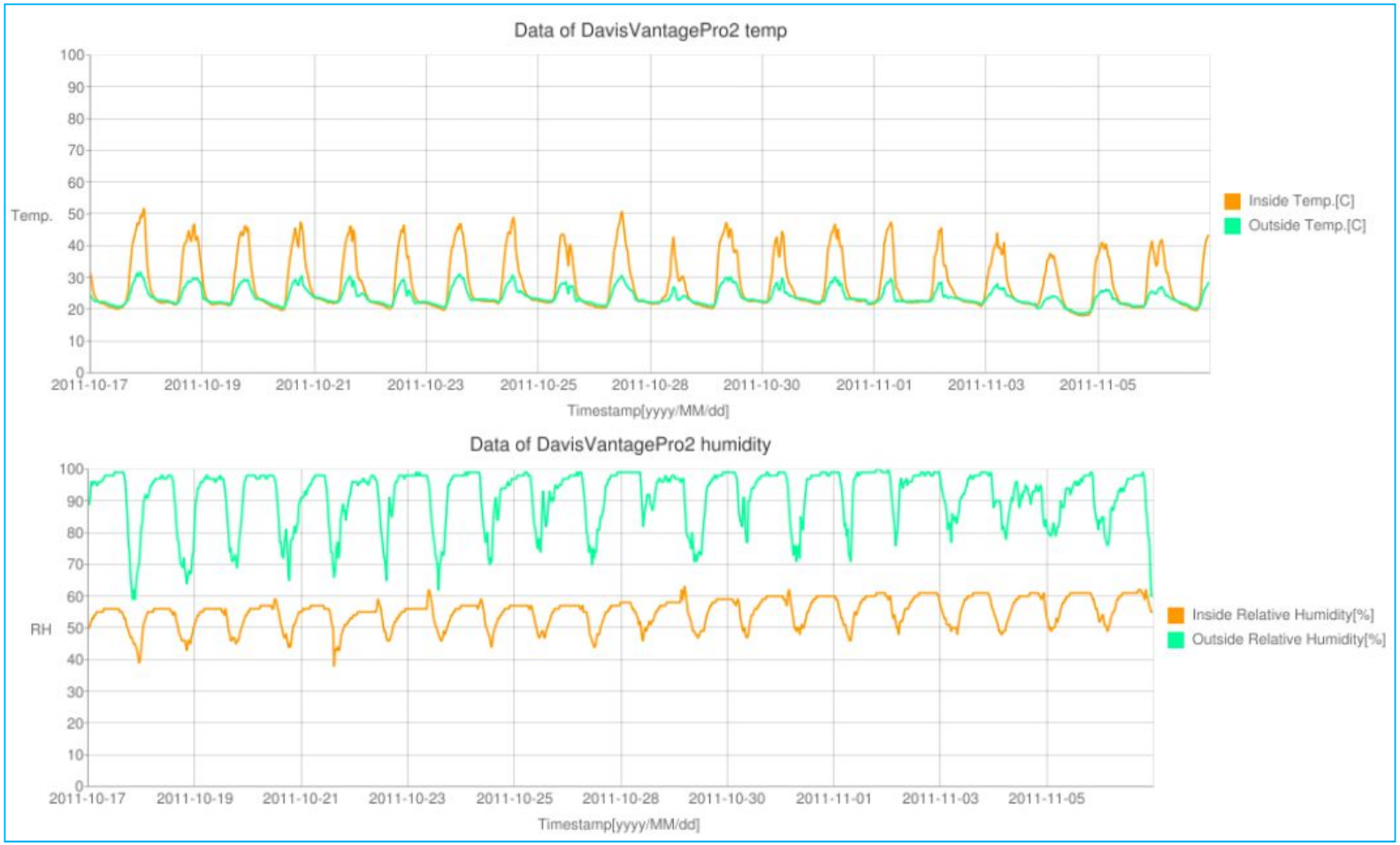
EXAMPLE: Temp & RH



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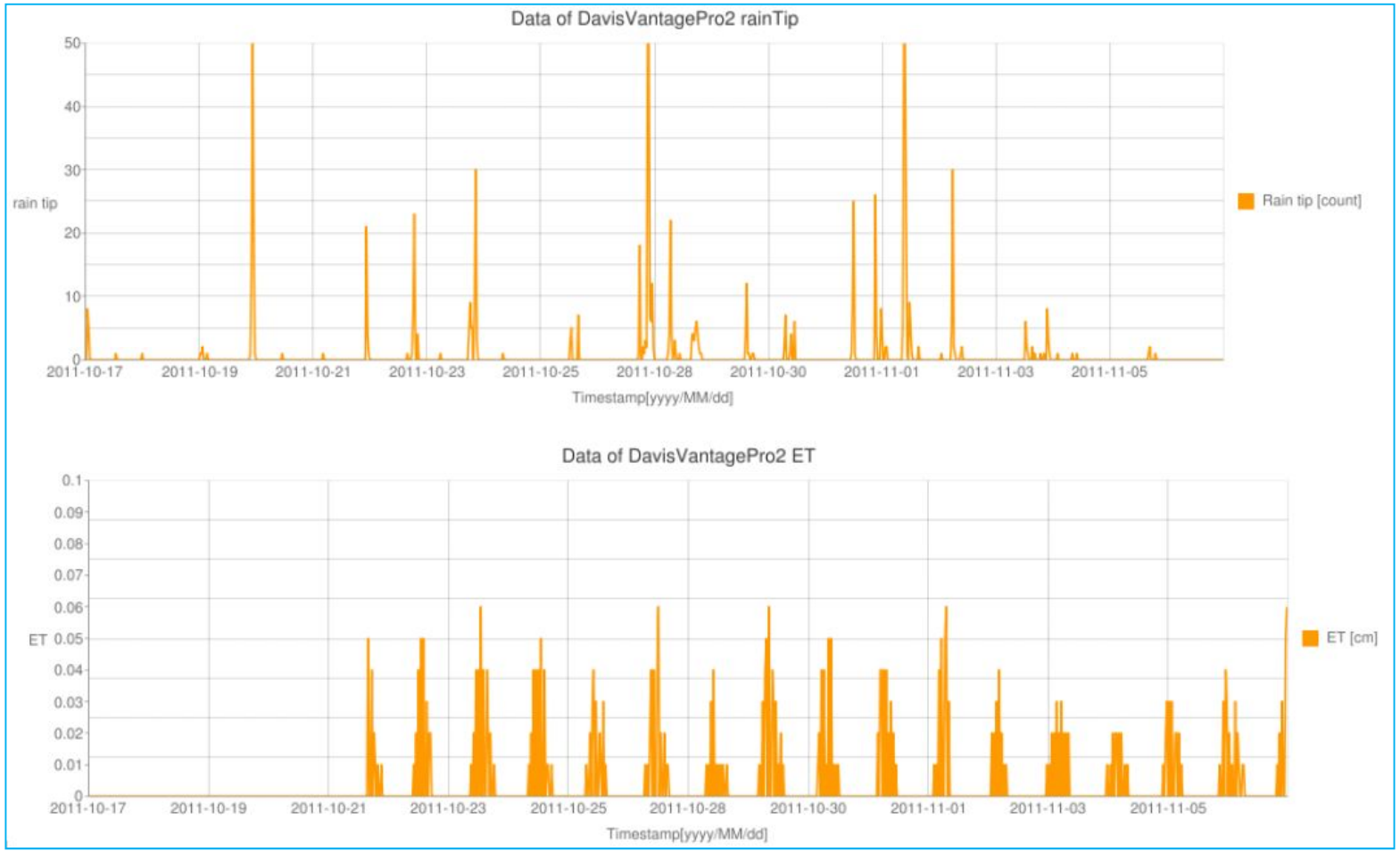
EXAMPLE: Rain & ET



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IWRM WEBSITE (Temporary)

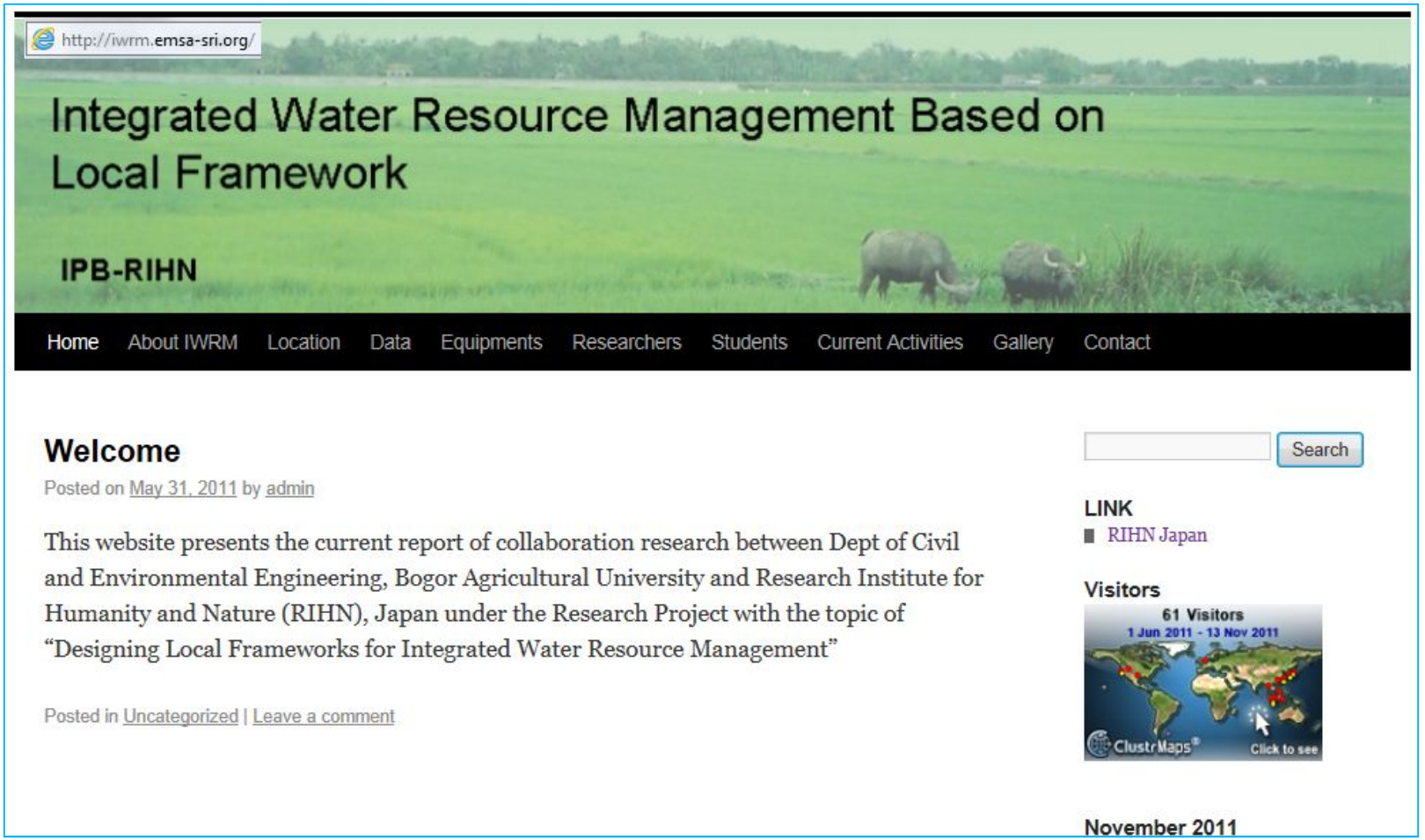

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Table 1 Cultivation practices generally recommended for SRI compared to conventional methods used under DISIMP schemes

Practices	SRI methods under DISIMP	Conventional methods (irrigated)
Land preparation (LP)	2 times: 1st LP for plowing	2 times: 1st LP for plowing
	2nd LP for puddling and leveling	2nd LP for puddling and leveling
	No standing water after 2nd LP	Standing water after 2nd LP
Nursery bed	Two methods were recommended according to size of paddy area: (a) use portable plates when paddy field area is less than 0.3 ha; and (b) establish seedbed on the ground in a corner of the main paddy field when the area of the paddy field is more than 0.3 ha.	Seedlings grown in flooded nursery with traditional methods
Seed		
Variety	Modern variety	Modern variety
Quality	80–100% certified seed	20–40% certified seed
Quantity	Transplanting at 5–8 kg/ha	Transplanting at 30–50 kg/ha, or Direct seeding at 60–100 kg/ha
Seedling age	8–12 days at transplanting	21–30 days at transplanting
Transplanting		
Seedling no.	1 seedling in each hill, transplanted at 1–2 cm depth;	3–5 seedlings in each hill, plunged into soil, variable depth;
Spacing	30 × 30 cm with regular distances	15–20 cm at random intervals
Irrigation		
Vegetative growth stage	Intermittent irrigation with wet–dry cycle; only shallow standing water during wet periods (±2 cm)	Continuous irrigation, keeping 5–10 cm of standing water on fields
Reproductive stage	Continuous irrigation, keeping 2–5 cm of standing water	Continuous irrigation, keeping 5–10 cm deep standing water
Weeding		
Method	Rotary weeder, weeding tools, or manual weeding	Use of weeding tools, or manual weeding
Frequency	2–3 times during vegetative growth stage	1–2 times during vegetative growth stage
Fertilizer use		
Type	Chemical fertilizer (50% reduction from standard) plus organic inputs	Chemical fertilizer recommended by the Dept. of Agriculture
Amount	Recommend urea 150 kg ha^{-1} urea and SP36 100 kg ha^{-1}; otherwise farmers still follow guidelines of the District Agricultural Office	Follow guidelines of the District Agricultural Office

THANK YOU

- Indonesia: Budi I. Setiawan, Agnes Rampisela, I Wayan Budiasa, Satyanto K. Saptomo, Chusnul Arief, Fadli Irsyad, Sutoyo, Suhardi Darusi
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