

Circulate irrigation scheme for paddy fields to conserve water environment and to increase water use efficiency

–Case Study in Japan–

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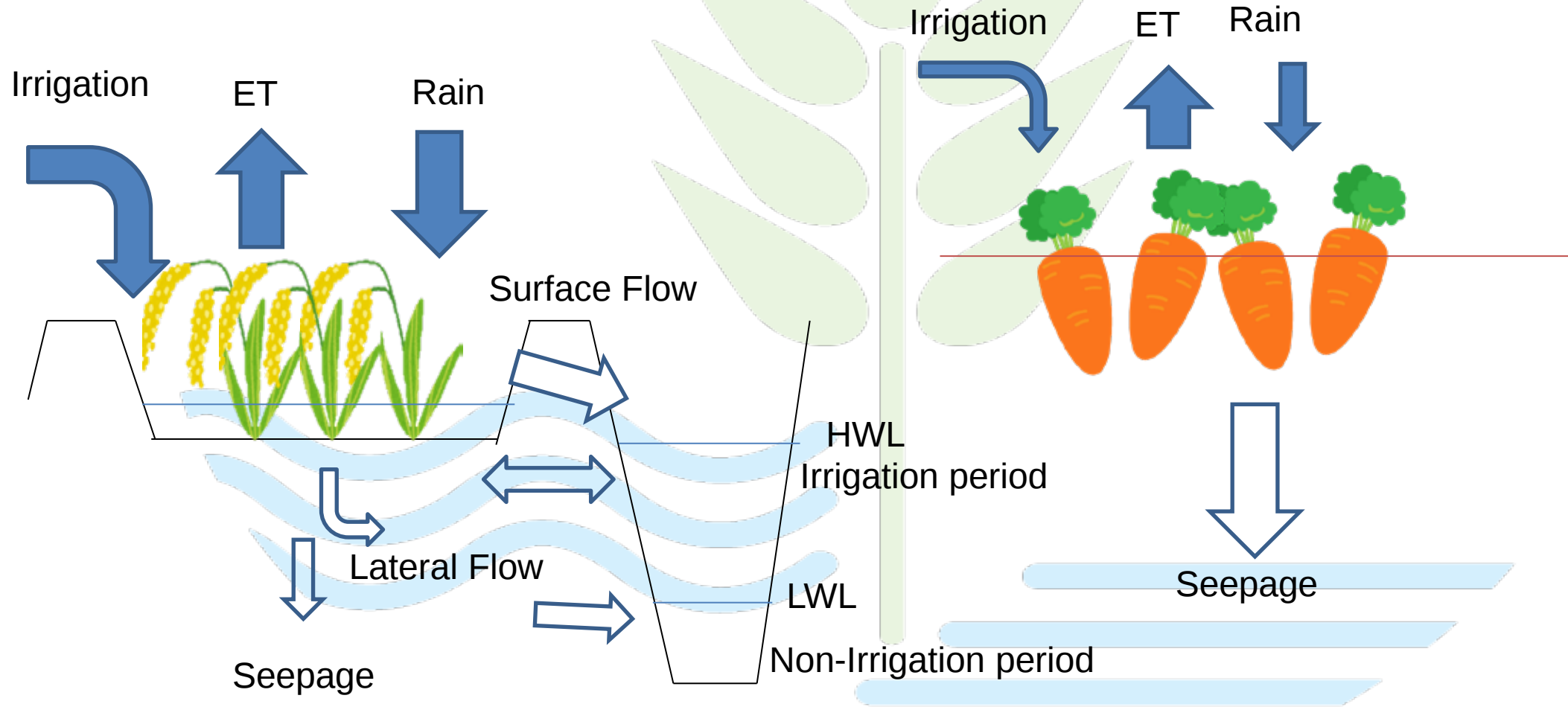
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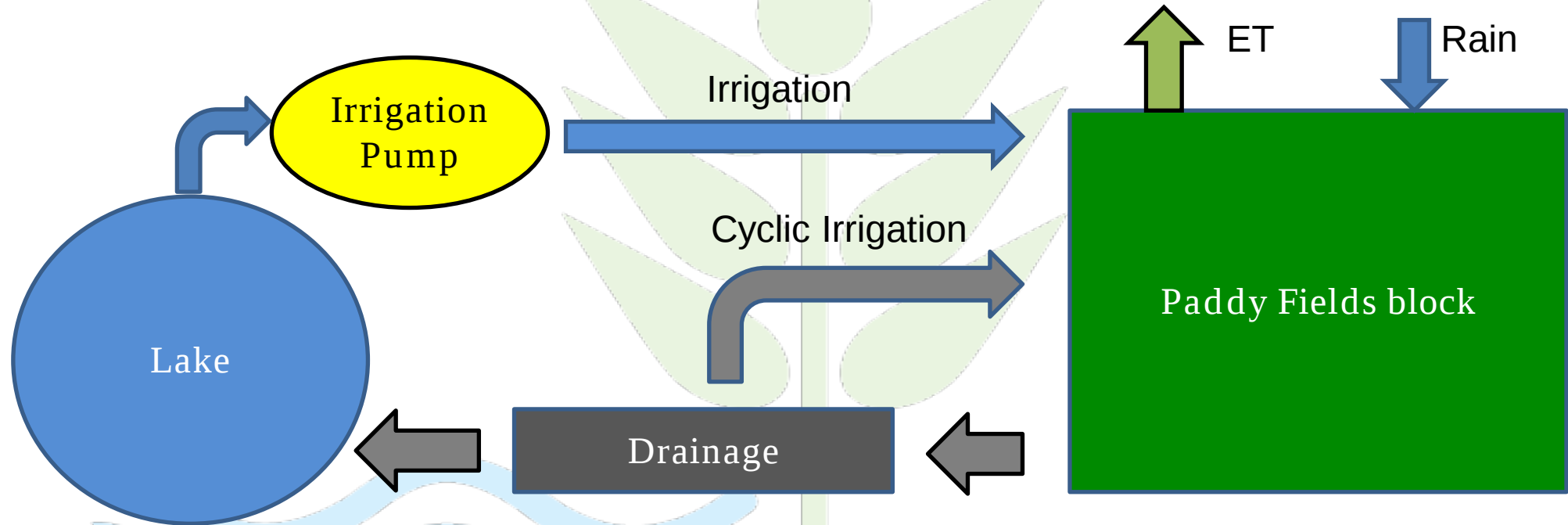
Adaptation to Climate Change in paddy fields water management

- .. Improve water use efficiency and **Reduction of blue water use**
- .. Conservation of **water environment**
- .. Eutrophication in lakes and reservoirs are well known issues
- .. Harder rainfall intensity or rainfall pattern could be triggered to impair water environment more
- .. Cyclic irrigation (Circulated reuse of drainage) is one of solution to improve sustainability

Hydrological process difference between paddy and upland area



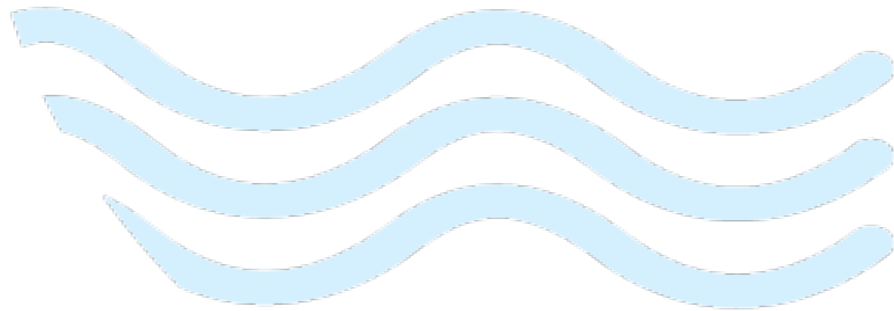
Cyclic irrigation scheme



Drainage water reuse is supporting to reduce blue water use

Cyclic irrigation in Japan

- .. Case study 1 Biwako lake
- .. Case study 2 Kasumigaura lake
- .. Case study 3 Shinji lake
- .. Case study 4 Inbanuma lake



Water environmental conservation 1

Case study 1: Biwako lake area (mg/L)

	Cyclic Irrigation	Cyclic Drainage	Irrigation (Conv.)	Drainage (Conv.)
SS	9.1	14	9.9	12
BOD	2.1	2.0	1.6	1.9
COD	3.3	3.5	2.8	3.5
T-N	1.0	1.2	0.92	1.2
T-P	0.13	0.18	0.11	0.16

Kaneki, JSIDRE, 1991

Case study 2: Kasumigaura lake area (mg/L)

	2008			2009			2010		
	Lake	Composite	Drainage	Lake	Composite	Drainage	Lake	Composite	Drainage
SS	27	25	25	32	35	34	26	51	22
T-N	1.5	1.7	1.8	1.7	2.1	2.4	1.6	2.0	1.7
T-P	0.15	0.20	0.23	0.17	0.30	0.34	0.18	0.32	0.20

Water Environmental conservation 2

Case Study 3 Shinji lake area

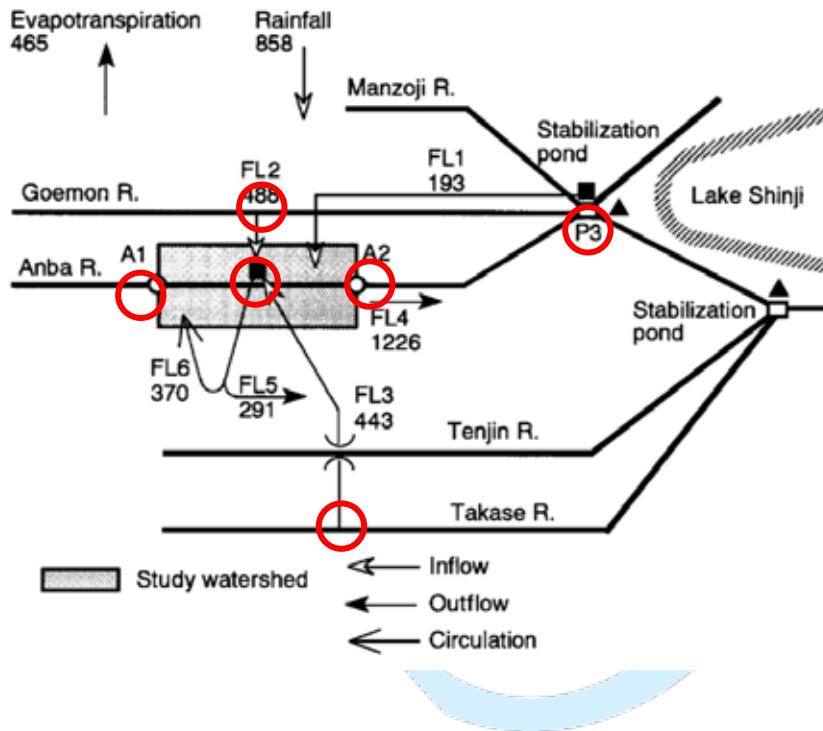


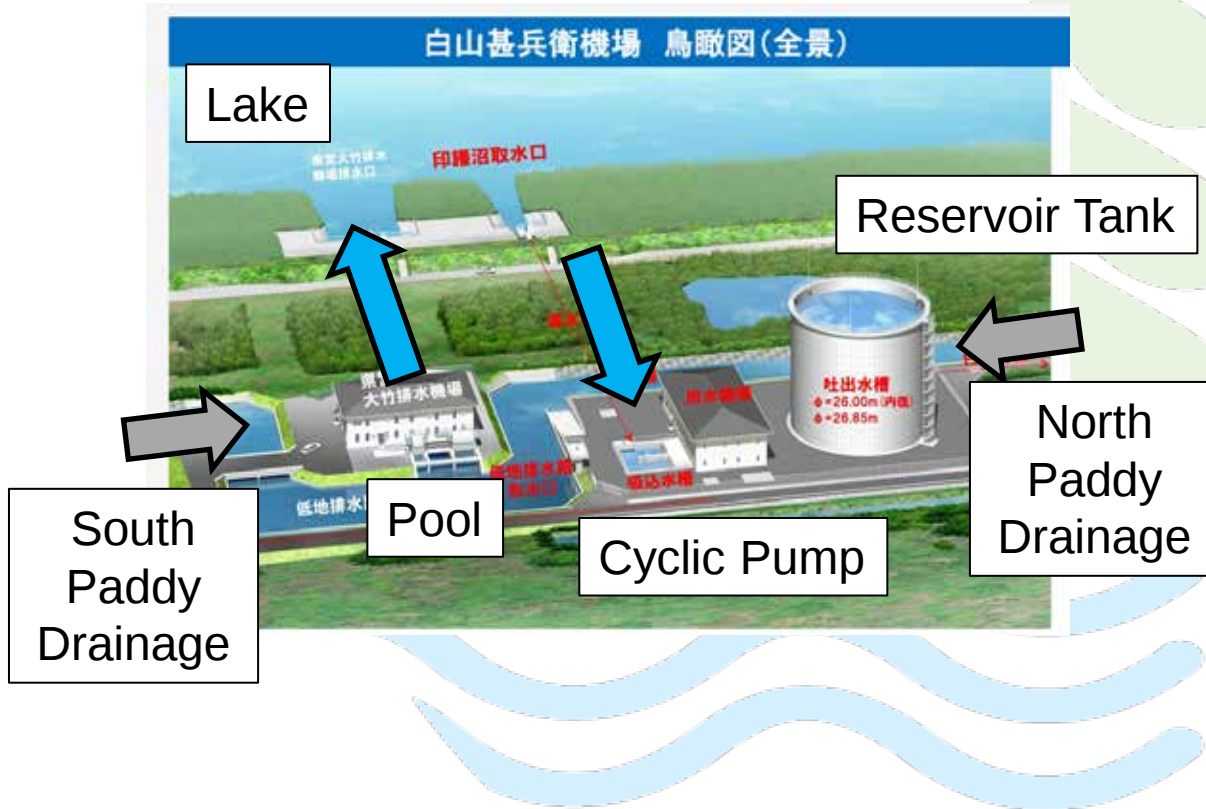
Table 2 – Mean concentrations at sampling points during the irrigation period and non-irrigation period

Sampling point	T-N (mgL ⁻¹)	NH ₄ -N (mgL ⁻¹)	NO ₂ -N (mgL ⁻¹)	NO ₃ -N (mgL ⁻¹)	T-P (mgL ⁻¹)	PO ₄ -P (mgL ⁻¹)	COD (mgL ⁻¹)
<i>Irrigation period</i>							
HY	0.583	0.030	0.002	0.232	0.055	0.015	1.7
A1	1.511	0.413	0.019	0.339	0.172	0.033	2.5
A2	1.607	0.439	0.019	0.349	0.142	0.023	2.3
P1	1.552	0.331	0.030	0.555	0.134	0.025	2.5
P2	1.859	0.480	0.017	0.472	0.162	0.031	2.5
P3	1.956	0.694	0.026	0.489	0.112	0.015	2.3
P4	1.524	0.248	0.015	0.728	0.147	0.029	2.5
<i>Non-irrigation period</i>							
HY	0.592	0.031	0.002	0.355	0.034	0.011	1.3
A1	2.479	0.923	0.025	0.467	0.161	0.018	2.5
A2	2.547	0.917	0.025	0.410	0.150	0.012	2.2
P3	2.597	1.051	0.034	0.516	0.100	0.010	2.1

The period for means of the Hii River and the Anba River is the entire investigation period (from October 1991 to April 2000). The period for means of pump stations is only irrigation periods because pump stations were not operated during non-irrigation periods. Symbols are corresponding to sampling points in Fig. 1(a) and (b).

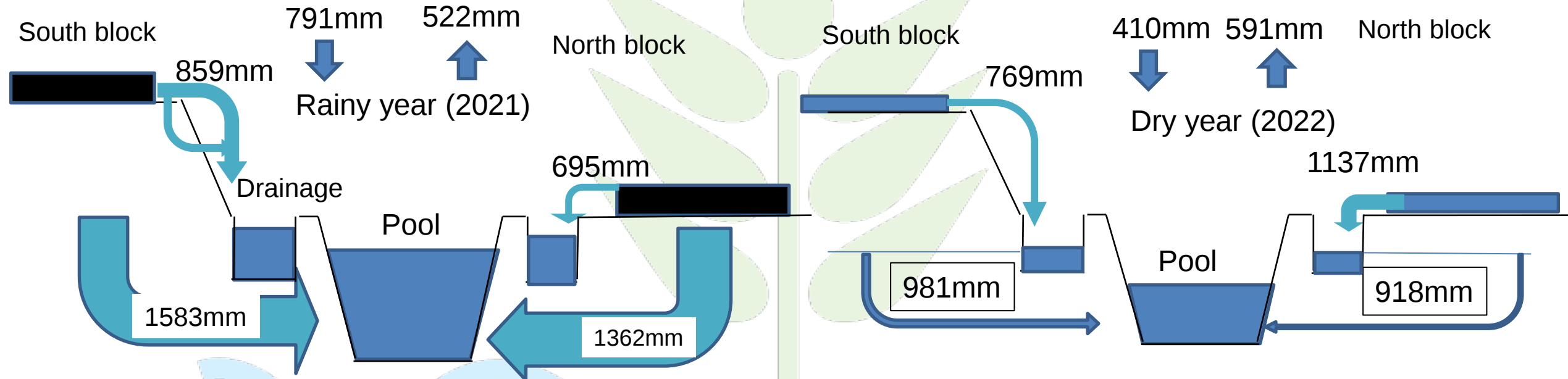
Water Environmental conservation 3

Case Study 4 Inbanuma lake area



	Lake	South Drain	North Drain	South Paddy	North Paddy
Electric Conductivity (mS / m)	28.03	33.76	35.25	34.47	34.67
T-N (mg / L)	1.32	1.22	1.27	1.01	1.51
T-P (mg / L)	0.11	0.10	0.10	0.12	0.17

Hydrological characteristics in cyclic irrigation



- .. In Dry year, pump water supply is accelerated, and ground water level would be lower
- .. In Rainy year, ground water level would be higher

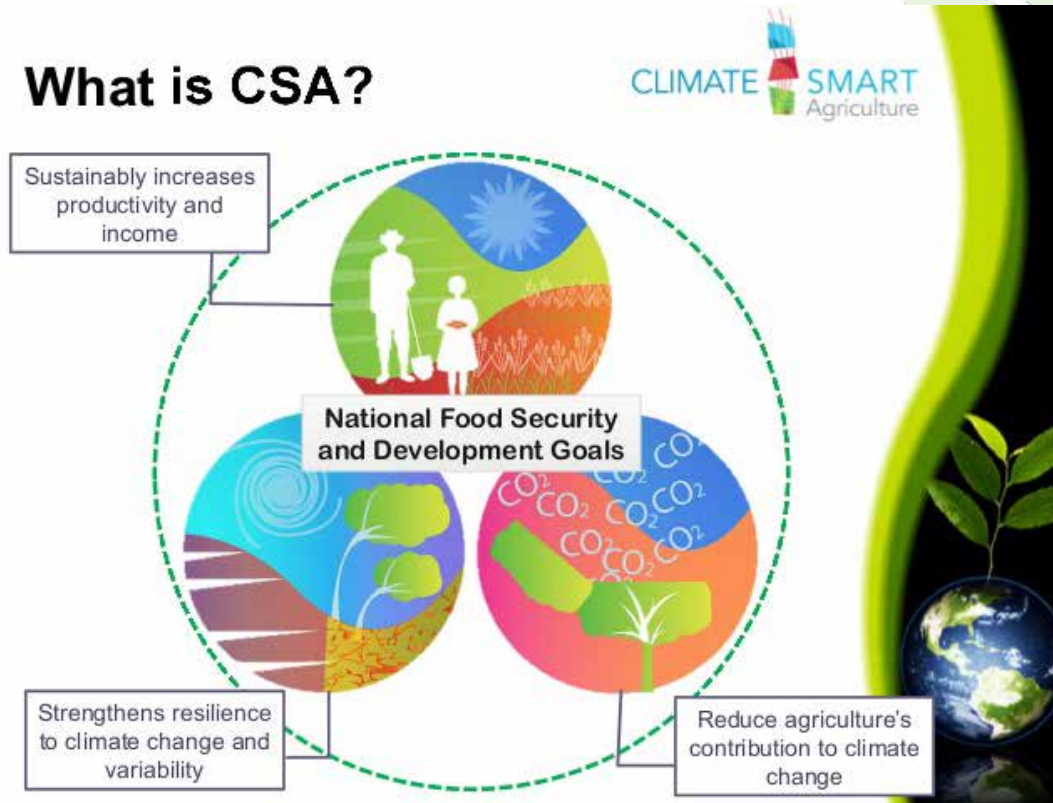
Discussion

- .. Cyclic irrigation will contribute to conserve natural lake to reduce drainage emission from paddy fields
- .. Probably, cyclic irrigation scheme will contribute Climate-Smart Agriculture (CSA)
- .. As adaptation aspect, pump irrigation and drainage water use will contribute to stabilize of water supply
- .. Food security aspect, yield is not changed through reuse of drain water

Mitigation under cyclic irrigation

- FAO-CSA requires productivity, adaptation and mitigation

What is CSA?



- Mitigation could be achieved by Alternate Wetting and Drying (AWD)
- AWD would be required reliable irrigation scheme with infrastructure

<https://csaguide.cgiar.org/csa/what-is-climate-smart-agriculture>

Conclusion

- .. Further discussion on FAO-CSA with circulation economy as adaptation
- .. Required Further research
 - ı Cyclic irrigation and material circulation
 - ı Water use efficiency
 - ı Water environment conservation



Thank you!
President
from TUAT