Value of Ecosystems Services provided by Irrigated Rice Agriculture : A case study in Thailand

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cirad

G-eau
Gestion de l'Eau, Acteurs, Usages

AIT

- Ecosystem services
- Valuation of Ecosystems Services : Practice and Challenges
- A case study in Thailand

ECOSYSTEM SERVICES

Introduction

- Increasing recognition that ecosystems
  - are providing multiple « services », but
  - many services are not properly taken into account
  - leading to ecosystems degradation (overuse, pollution, etc.)
- Need to value those services to better manage ecosystems:
  - Make these services more **« visible »**
  - Produce a more balanced set of services

The idea is not new…

- Plato (Antiquity) → already talk about effect of deforestation on water services
- Early ecological movements (70's, 80's)
- Costanza, R., et al. (1997). The value of the world's ecosystem services and natural capital. *Nature.*

  → Total value of ES on earth
- Millenium Ecosystem Assessment → methodological framework (2003-5)
- TEEB (2007-) → Cost-Benefit Framework
  - The *costs of the loss of biodiversity & ES* versus the *costs of effective conservation*

Alternative definitions

- *“The benefits people obtain from ecosystems” (MEA)*
- *“Ecosystem services are not the benefits humans obtain from ecosystems, but rather, the ecological components directly consumed or enjoyed to produce human well-being” (Boyd J. et Banzhaf S. ,2007)*

Different visions of Ecosystems

Stock-Flow

- **« Stock »** of matter & stored energy, that can be transformed into economic products and then returned to nature as **waste (« Flow »)**
- Products
  - Are physically **transformed**
  - Used at a **chosen rate**
  - **can** be stockpiled
  - are quantitatively **used-up**

Fund-Flux

- **« Fund »** that provides a regular **« flux »** of services
- Flux
  - Are **NOT** materially transformed into what they produce
  - Can only be **used at a given rate** that we do not control
  - Can**not** be stockpiled
  - Are worn out when consuming, **not used up**

Configuration matters

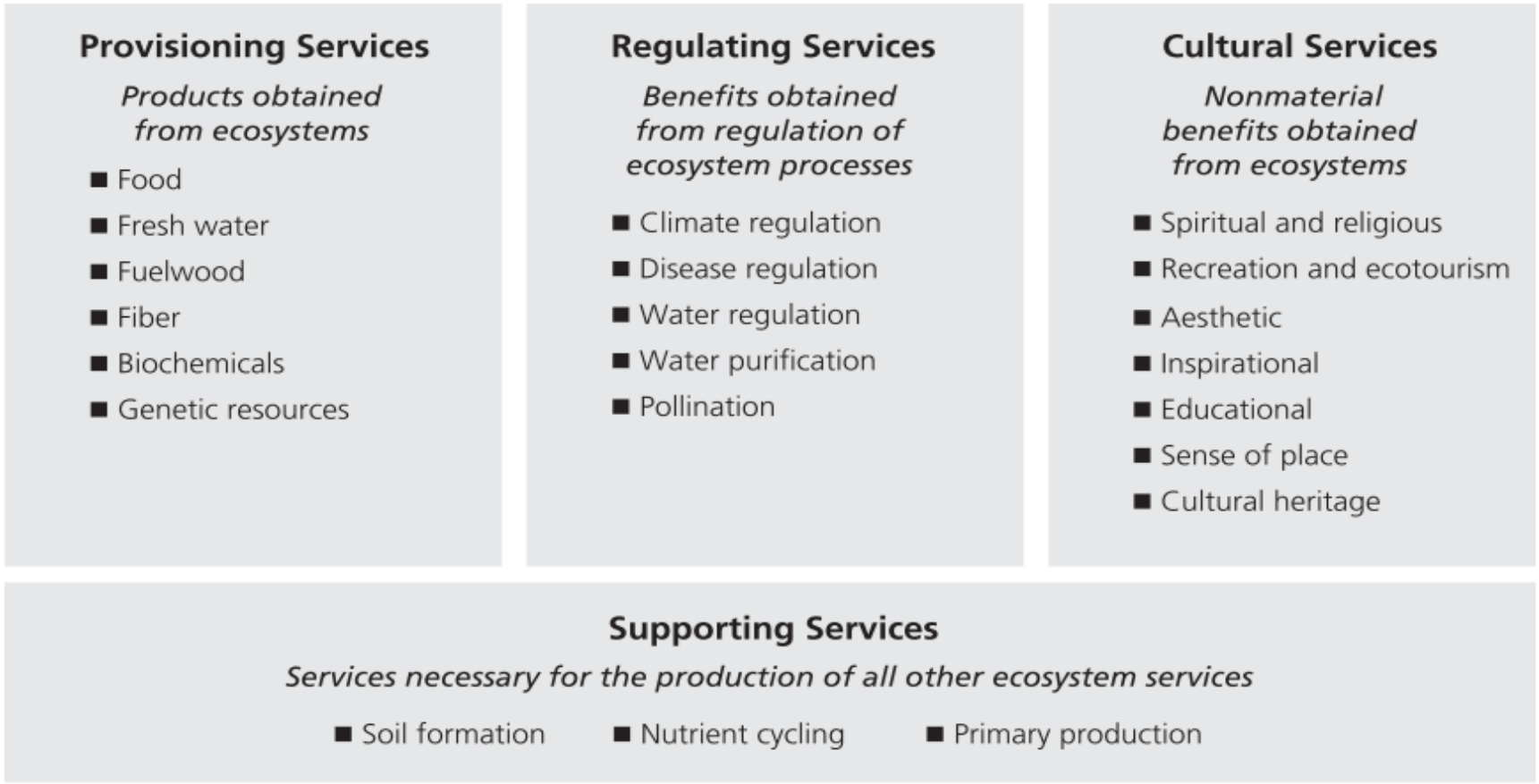
- Fund is **<u>a particular configuration</u>** of a given stock of resource
  - Automobile
    - Stock of steel, plastic,…
    - A particular configuration of steel, aluminium, plastic
    - A Fund of transportation services
  - After a car accident
    - the same stock of steel, aluminium, plastic
    - but cannot not provide services anymore!

What do we want from ecosystems?

- We want to **maintain some natural capital** (fund), that will **produce some functions of use to humans** (flux)

- **Stock alone is not enough** since different configurations of capital will generate different flux of services

Functional classification



Millennium Ecosystem Assessment. (2003). Ecosystems and human well-being: A framework for assessment. Island Press, Washington D.C.

Challenges with ES

- Relationship between configuration and flux is often not well understood
  - Ecosystems are complex
  - *Difficult to know what configuration is needed*
- Decision making requires some ideas about the cost and benefits of maintaining ES?
  - ***What is the value of the ES produced?***
    - What services are we valuing?
    - How do we calculate the value of the services (market/no market conditions)

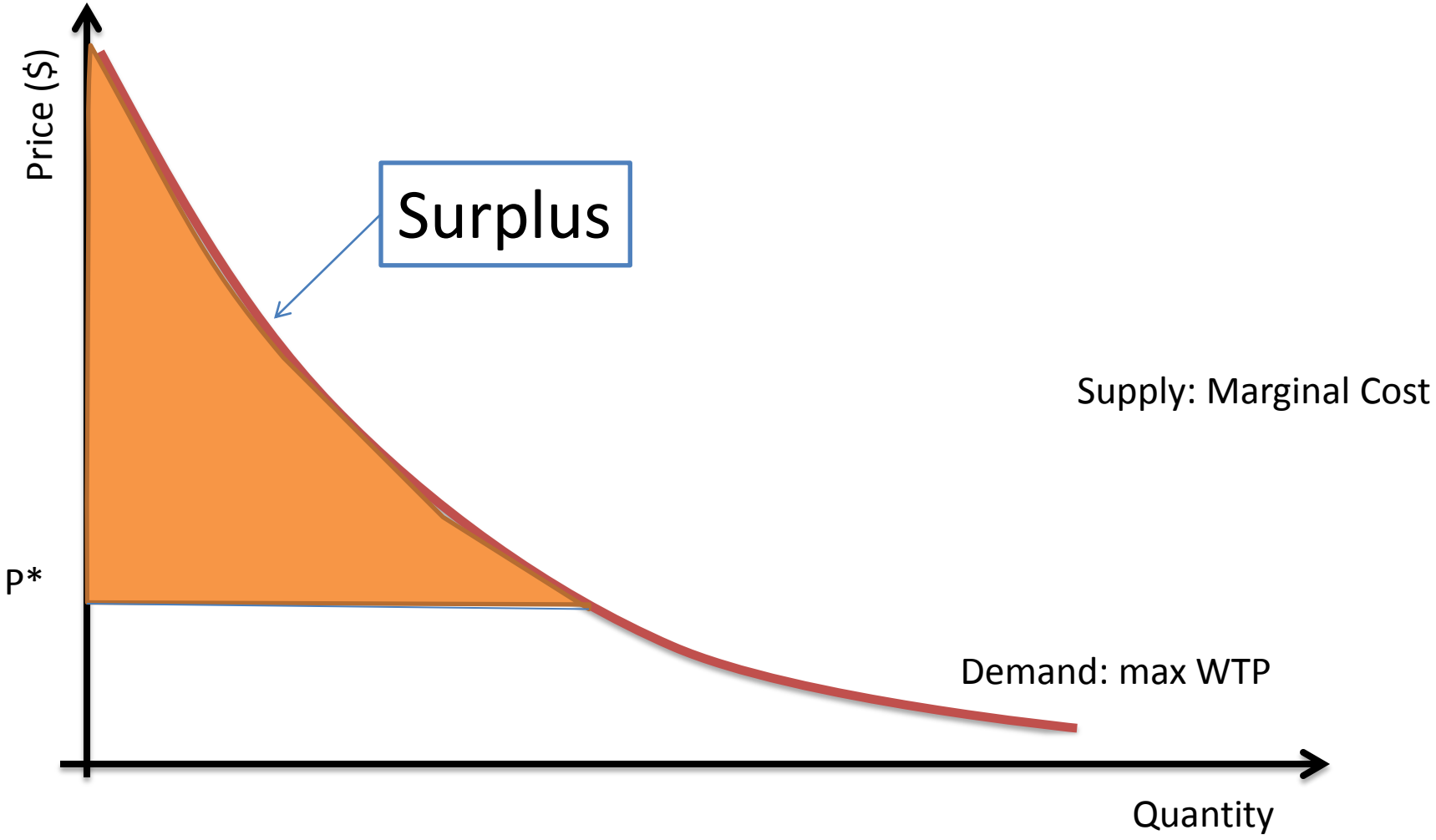
VALUE OF SERVICES
&
WELFARE ECONOMICS

WTP – WTA

- **Transform well-being effects into monetary units**
- Willingness to Pay: Maximum amount of money you would be willing to pay to:
    - Get access to the good/service
    - Avoid a bad / dis-service

- Willingness to Accept:
  - What is the minimum amount of money you would require to make you indifferent between current situation and:
    - Be exposed to an additional bad / dis-service
    - Lose access to an existing good / service

Value in economics: market case



Without markets: Demand curve approaches

Revealed preference methods

- Based on actual observable choices and from which actual resource values can be directly inferred (mostly based on actual market prices or costs incurred)
  - Travel Cost Method
  - Hedonic pricing

Stated preference methods

- Elicit respondents' WTP when the value is not directly observable → hypothetical markets
  - Contingent valuation: one scenario = bundle of services
  - Choice modelling : ≠ bundles of services contrasted on important attributes

2 MAIN QUESTIONS REMAINING

(… BESIDES UNDERSTANDING HOW THE SYSTEMS WORK!)

Framework:
Is Valuation & CBA the right approach?

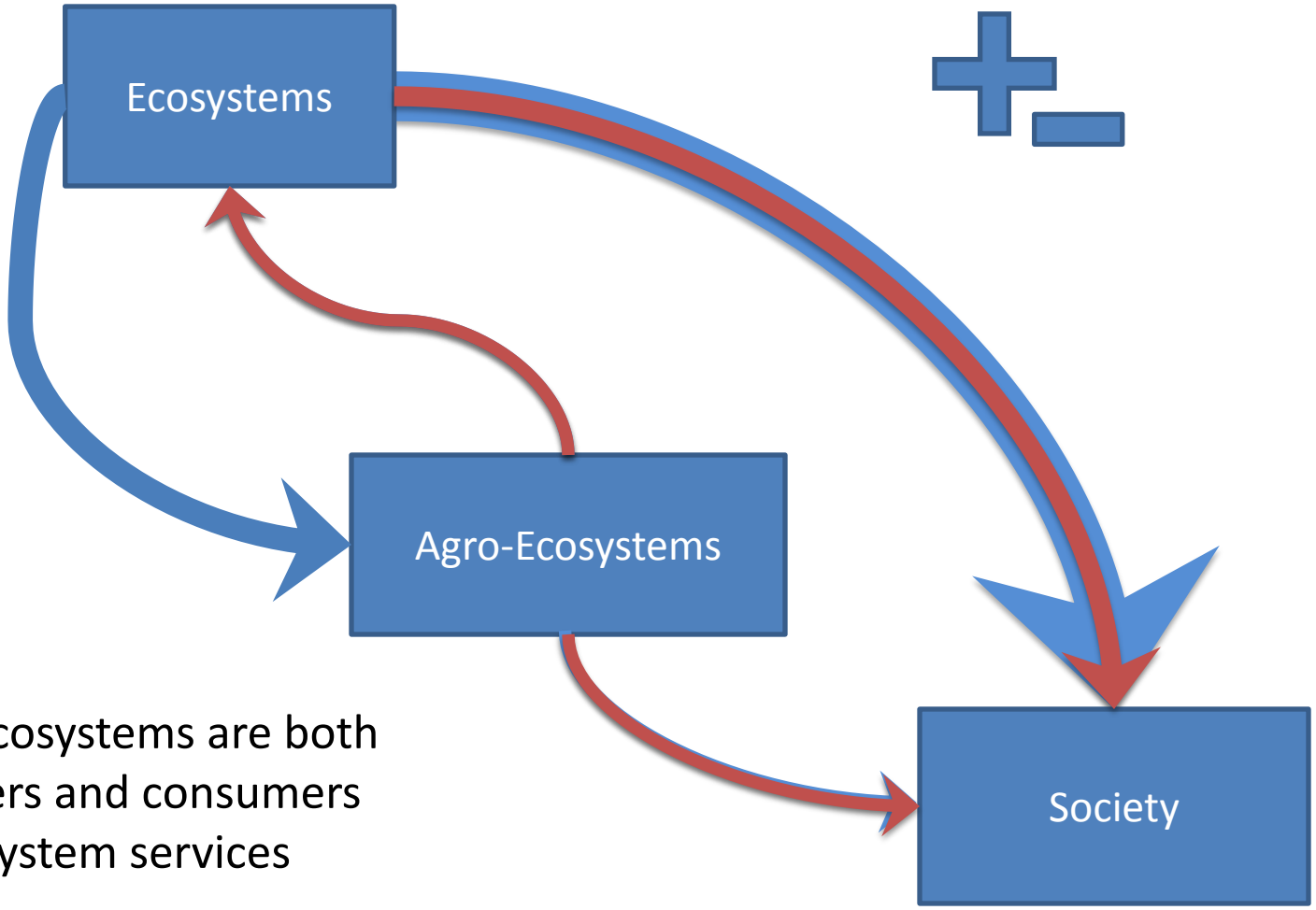
- **Substitutability** of services?
  - Implicit when valuing services
  - Some services may be difficult to replace
- **In-commensurability of the different services provided**
  - Impossibility to trade-off…
  - Multi-criteria decision making (non compensatory) necessary?
- ***Intrinsic*** vs. ***instrumental*** value of ecosystems:

Methodological: Do we capture the right value?

- Double counting of some services?
- Hypothetical bias
  - Functions not well understood
  - Value more things once they have disappeared
- Strategic behavior
  - Incentive to « declare » higher WTP
  - Public good → free ride?
- Scale effect
  - WTP for moral conscience but not proportional to the problem
  - WTP equal for one ha of wetland than for the entire wetland → aggregation is difficult
- WTA >>>> WTP

AGRO-ECOSYSTEMS & ECOSYSTEM SERVICES

A complex relationship



Agro-ecosystems are both providers and consumers of ecosystem services

Irrigated Rice in N-E Thailand

- Identify a set of market value and non-market value potentially delivered by irrigated agriculture (focus groups)
- Stratified sample (350) of different segment of the population (rural/urban and socio-economic status) in Nakhon Ratchasima province
- Analyze weighting of market and non-market functions (multi-criteria paradigm → AHP)
- Value different functions of irrigated agriculture (Willingness to Pay → Choice Modelling)

ES of irrigated rice agriculture

Main Services	Economic services (Weco)	Social services (Wsoc)	Environmental and Regulating services (Wenv)	Cultural and Recreational services (Wcul)
Sub-services	1. higher yields and better income (Weco1)	1. Sufficient food throughout the year (food security)	1. Conserve ecosystems and biodiversity (Wenv1)	1. Maintain rural landscapes (Wcul1)
	2. Employment in the agro-industrial sector, improve the local economy	2. Decrease migration to urban areas	2. Suppress flow to mitigate flooding	2. Maintain rural lifestyles and inherit cultures and tradition (Wcul2)
		3. Create a strong sense of community	3. Mitigate droughts (Wenv3)	
			4. Maintain water quality (Wenv4)	

Economic | **Social** | **Environment** | **Culture&Recreation**









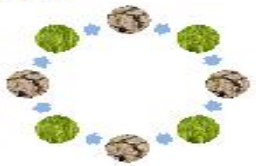


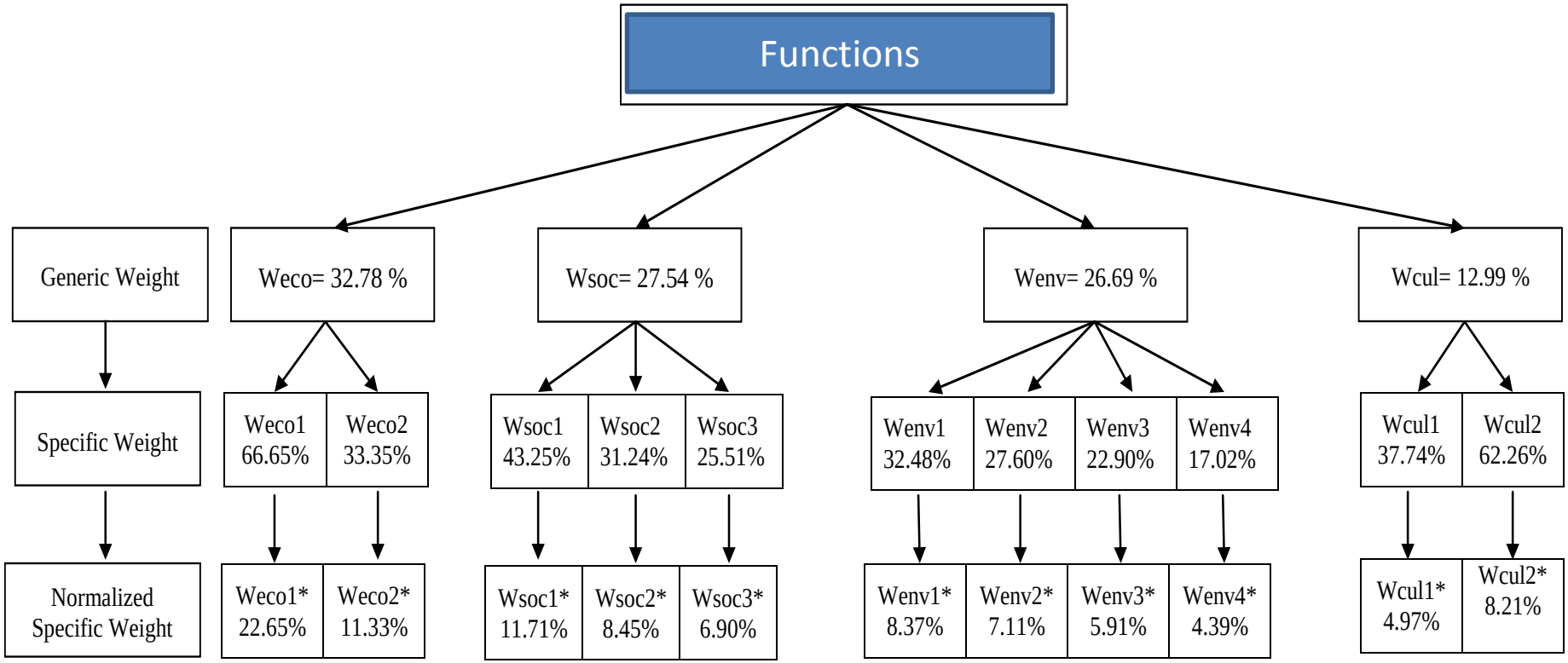
Multi-criteria analysis (AHP) ➔ weighting of the different functions

Choice Experiment & WTP for non-market functions

Block 2-Set 1

กรุณาเลือกแผนการที่ท่านชอบมากที่สุด และกากบาท (x) ลงในช่องทางเลือกที่ท่านเลือก

หน้าที่และคุณประโยชน์จากระบบและพื้นที่ชลประทาน	สถานะปัจจุบัน	ทางเลือก 1	ทางเลือก 2
1.มีแหล่งน้ำเสริม/ ปลูกข้าวในฤดูแล้งได้ มีผลผลิตเพิ่มมากขึ้น	 ผลผลิตเฉลี่ย 360 กก./ไร่/ปี	ได้ผลผลิตเพิ่มขึ้นปานกลาง  ผลผลิตเพิ่มเป็น 600 กก./ไร่/ปี	ได้ผลผลิตเพิ่มขึ้นปานกลาง  ผลผลิตเพิ่มเป็น 600 กก./ไร่/ปี
2.บรรเทาผลกระทบจากปัญหาภัยแล้ง	ความถี่ของการเกิดภัยแล้ง เกิดขึ้นเกือบทุกปี 	ความถี่ของการเกิดภัยแล้ง ปีเว้นปี 	ความถี่ของการเกิดภัยแล้ง ปีเว้นปี 
3. ควบคุม ดูแลรักษาคุณภาพน้ำในคลองชลประทานและลำน้ำธรรมชาติ	คุณภาพน้ำปานกลาง ใช้ได้เฉพาะภาคเกษตร (2 ดาว) 	คุณภาพน้ำปานกลาง ใช้ได้เฉพาะภาคเกษตร (2 ดาว) 	คุณภาพน้ำสูง ใช้อนุรักษ์สัตว์น้ำ ลงเล่นน้ำได้อย่างปลอดภัย (3 ดาว) 
4.พื้นที่เกษตร ทำให้คงไว้ซึ่งวิถีชีวิตเกษตร วัฒนธรรม ประเพณี และมีภูมิทัศน์สวยงาม	วิถีชีวิตเกษตรเสื่อมถอยลง พื้นที่บางส่วนถูกปล่อยทิ้งร้าง 	พื้นที่บางส่วนถูกปล่อยทิ้งร้าง ไม่มีกิจกรรมทางการเกษตร 	คงไว้ซึ่งวิถีชีวิตเกษตรวัฒนธรรม ประเพณี และมีภูมิทัศน์สวยงาม 
จำนวนเงินที่ท่านเต็มใจจ่าย (บาท/ครัวเรือน/ปี)	0	800	1600
ท่านเลือกทางเลือก			


Functions
Generic Weight
Specific Weight
Normalized Specific Weight
Weco= 32.78 %
Weco1 66.65%
Weco2 33.35%
Weco1* 22.65%
Weco2* 11.33%
Wsoc= 27.54 %
Wsoc1 43.25%
Wsoc2 31.24%
Wsoc3 25.51%
Wsoc1* 11.71%
Wsoc2* 8.45%
Wsoc3* 6.90%
Wenv= 26.69 %
Wenv1 32.48%
Wenv2 27.60%
Wenv3 22.90%
Wenv4 17.02%
Wenv1* 8.37%
Wenv2* 7.11%
Wenv3* 5.91%
Wenv4* 4.39%
Wcul= 12.99 %
Wcul1 37.74%
Wcul2 62.26%
Wcul1* 4.97%
Wcul2* 8.21%

Public WTP for maintenance of selected services

	WTP	S.D
Yield (USD/T)	7.6	1.8
Drought (USD/10%)	8.5	1.1
Envt / water quality 1 (USD)	46.2	7.6
Envt / water quality 2 (USD)	60.1	9.0
Lifestyle / landscape (USD)	53.2	5.5

Note: the above non-market benefits were calculated from CE results

Conclusions

- ES: easy to understand / difficult to measure!
  - Double counts of certain functions
  - Strategic behavior of some populations?
  - Scaling effect
- MCDM & Choice Modelling → different results
  - Ranking in importance does not always translate in WTP
  - Some attributes not considered (ANA)