

# Master Class report

1	Title of Master Class						
	Building Capacities for Integrated Agricultural Catchment Management						
2	Goal/ Aim of Master Class						
	The concepts of Integrated Assessment (IA) and Integrated Catchment Management (ICM) provide holistic frameworks and a set of multidisciplinary and interdisciplinary tools that have been developed to investigate and communicate the effects of policy and management options to decision-makers and the wider community. Without such approaches, achieving sustainable agriculture and food production into the future, whilst maintaining or improving the condition of the landscapes and ecosystems on which industries and communities depend, will remain elusive. The primary objective of this Master Class was to develop or enhance the capacity of planners, managers, and policy makers to undertake holistic planning that improves water management and agriculture across South East Asia. We aimed to build participants' integration skills and encourage them to adopt and promote integrated approaches to project development, implementation and evaluation.						
3	When and where was the Master Class conducted?						
	The Master Class was held at the Royal Irrigation Department (RID)teaching facilities in Bangkok, 26 <sup>th</sup> to 30 <sup>th</sup> October, 2015						
4	No of participants and countries represented						
	26 representatives from Thailand participated in the workshop, primarily from offices in the RID (Office of Public Participatory Promotion (OPPP), Office of Water Management and Hydrology, Office of Project Management, Irrigation regions, Office of Research and Development). Representatives from the Department of Water Resources also attended the workshop. An overview of the work roles of the participants of the participants and their previous exposure to both modelling and integrated assessment methodologies is provided in Appendix 4.						
	Whilst no representatives from other countries attended the workshop, this allowed two of the participants (Wachiraporn Kumnerdpet and Chanin Songchon) to act as interpreters throughout the workshop (with support from Dr Vanida Khumnirdpetch from Wednesday to Friday. This was of great benefit to the participants by (a) allowing them to work together on, and present, group exercises in Thai, and (b) helping to communicate the key concepts of integrated assessment, social science and Bayesian networks (to which most had not previously been exposed to). The essential role played by Wachiraporn and Chanin, in particular, requires consideration of translation requirements in any future IACM Masterclass, especially if participants from multiple countries attend.						
5	Presenters (Names and Institutions)						

	Anthony Jakeman and Wendy Merritt (ANU), Allan Curtis (CSU), Serena Hamilton (ECU)								
6	Co-Sponsors and organisations providing (in-kind) support								
	Co-sponsor: The Office of Agricultural Affairs, Royal Thai Embassy								
	In-kind: Royal Irrigation Department, ANU (Jakeman), CSU (Curtis), ECU (Hamilton)								
`7	Expected outcomes and potential benefits to Australia								
	The expected outcomes of the Masterclass were that participants would:								
	• Extend their capacity to understand the complex contexts in which catchment managers work, appreciate the barriers that can be encountered and explore how things could be done differently								
	<ul> <li>Build an understanding of the fundamental principles underpinning IACM</li> <li>Build an understanding of the IACM implementation, and requirements for successful application</li> </ul>								
	<ul> <li>Explore the diversity and complexity of issues that can be managed using an IACM approach</li> </ul>								
	<ul> <li>Develop their understanding of how IACM can be effectively implemented in their areas of interest, including challenges and opportunities for successful outcomes</li> </ul>								
	<ul> <li>Get an overview on the wide range of analytical and participatory techniques and tools available to support IACM</li> </ul>								
	<ul> <li>Develop their understanding of which techniques and tools they can use to support the application of IACM in their areas of interest, including required skills and resources</li> </ul>								
	Achieving these outcomes would directly benefit participants in their current employment activities (and future opportunities) and enhance institutional capacity and planning activities of their organisations. Thailand is south-east Asia's second- largest economy and with its substantial economic and research capabilities, the formal partnership with the Office of Agricultural Affairs, Royal Thai Embassy and support of the RID has potential to benefit Australia. This could be through the development of joint research initiatives in the future or learnings for Australia's agricultural industries. Meetings were held with the RID, Dr Vanida Khumnirdpetch from the Royal Thai Embassy, and representatives from the Australian Embassy and Thai universities to discuss the potential for collaborative projects.								
7	<b>Participant's feedback (</b> Please provide information on the outcomes of the course from the participants point of view and the likelihood of application of skills, including learning in the workplace and transfer of skills, including barriers such as lack of equipment or research facilities)								
	Details on the evaluations and the workshop program are provided in Appendix 5 and 7, respectively. Participants were asked to provide feedback on the benefit and technical level of each session, which components they would have liked more (or less) content, and whether they think they have more skills now to develop and implement integrated approaches. The responses were generally positive, with the 'role of social science', 'integrated assessment and modelling' and 'Bayesian networks' components being most appreciated. The practical sessions were well received with a high level of interaction and good will between participants during the session and appreciation of the flexibility in tailoring tutorials to the Thai								

context (e.g. "I [am] extremely grateful about your work process that was improved all the time (dynamic work process)"). The earlier sessions were more technical and had less tutorials; modifying these sessions to include more interaction and group activities would be advisable for future workshops. Most participants could see the value of integrated approaches, including Bayesian networks, in their work. However, about half of the surveys we received were from participants who were not sure whether they would now have the skills to develop and implement integrated projects. Some identified that they would like advanced training and that this could be in the form of a specifically designed integrated project. This is a good point as the objective of this workshop was to introduce participants to integrated assessment methodologies. We have found that beyond introductory workshops, a project-based project is a good approach to further training and increase capacity in undertaking integrated assessment and modelling. Other participants identified that their current work roles and responsibilities may be a barrier to them applying integrated approaches; they are not funded to do this work and there needs to be more effort to increase interactions between the various agencies involved in water management in Thailand. This is reflected in the latest Thailand National Plan of Water Management, presented by Phattaporn Mekpraksawong, which demonstrated the need and will to implement more integrated approaches to water management.

# Appendix Introductory session

Participants' work roles and coverage across water and policy sectors

A short survey was conducted on day 1 (Monday) gain some information on the disciplinary background of the participants and their main work roles (see below).

#### Work roles

We are interested in your work background and previous experience with integrated assessment approaches to catchment management or agriculture.

1. What is your name?

2. At what institution and department do you work?

	2
- A State	3
	4 a

Role	Relevance to your work						
Policy development	Not relevant						
	Limited						
	Moderate						
	□ Main role						
Collection and analysis	Not relevant						
of social data	□ Limited						
	Moderate						
	□ Main role						
Land use planning	Not relevant						
	□ Limited						
	□ Moderate						
	□ Main role						
Irrigation planning	Not relevant						
	□ Limited						
	Moderate						
	□ Main role						
Hydrology modelling	Not relevant						
	□ Limited						
	□ Moderate						
	Main role						
Other role (please	Not relevant						
specify):	□ Limited						
	Moderate						
	Main role						

4. Is this your first exposure to Integrated Assessment approaches to agriculture and catchment management? If no, please summarise your previous exposure.

Of the 20 surveys that were filled in, most participants identified multiple roles in their work. An overview is provided in the table below. Although most participants were from RID Offices, the group had a breadth of disciplinary backgrounds (economists, engineers, planners, hydrologists) and worked across a number of policy and water sectors. A mapping session was undertaken on Day 1 to identify these sectors (see figure below). This, together with the presentation on 'Water Resources management strategy (BE.2558-2569)' given by Phattaporn Mekpraksawong, was used to modify and guide the group exercises on days 2 to 5 of the workshop.

Work roles	Limited role	Moderate role	Main role
Policy development	4	3	2
Collection and analysis of data	8	4	2
Land use planning	7	2	
Irrigation planning	7	3	4
Hydrological modelling	5	4	1
Project planning (basin)			1
Environmental impact assessment			1
Dam safety			1



[Above] Water and policy sectors covered by workshop participants (Adapted from Neil S. Grigg. (2008) Integrated water resources management: balancing views and improving practice, Water International, 33:3, 279-292)

#### Participants' previous modelling experience

Participants were also surveyed on day 1 to gain understanding of their experience in the development and use of models (18 forms were filled in). About half of the survey respondents reported experience with

hydrological modelling (mainly for irrigation planning, flood control and hydraulic modelling) and crop water use models. One participant reported prior exposure to integrated assessment methodologies. Generally, participants reported more experience with model set-up, simulation and estimation of impacts; they reported less experience with model scoping (defining model objectives, system boundaries, stakeholders, and issues of concern). The focus of the workshop and tutorials was on model scoping, integrated assessment and the role of social science and conceptual modelling meaning that much of the material was quite new to the participants.

1	Modelling experience We are interested in your e	e xperience in the development and use of models for yeart management or aggiculture											
	<ol> <li>Do you have hydrology modelling skills (Yes/No)? If so, what models (maximum 3) and how do/did you use them?</li> </ol>												
	Model name	Purpose of use											
		Not relevant											
		Irrigation planning											
		Water allocation											
		Water quality											
		<ul> <li>Other purpose (please specify)</li> </ul>											
Contraction of the second		□ Not relevant											
		□ Irrigation planning											
		Water allocation											
the lot of the lot of the		U Water quality											
		Other purpose (please specify)											
		Not relevant											
		Irrigation planning											
		Water allocation											
		Water quality											
		<ul> <li>Other purpose (please specify)</li> </ul>											
	2. Do you have crop model	ling skills (Yes/No)?											
	If so, what models (maxi	mum 3) and how do/did you use them?											
	Model name	Relevance to your work											
		Not relevant											
a we I will there is		Crop water use											
AL CARDEN		<ul> <li>Other purpose (please specify)</li> </ul>											
<b>家家教育教育教育</b> 会。在		Not relevant											
CAN DATE KARS OF		Crop water use											
		<ul> <li>Other purpose (please specify)</li> </ul>											
A REAL PROPERTY AND		□ Not relevant											
		Crop water use Colored and Co											
THE CRAWFORD FUND For a Ford Score Ford		<ul> <li>Other purpose (please specify)</li> </ul>											
	L	1											

3. Do you have experience in collecting and analysing of socio-economic data? If so, please summarise your experience.

4. If you have developed or used models in your work, have you involved stakeholders in the development process? If so, please summarise who they were and how they were involved.

5. If you have developed or used models in your work, how much time have you spent on each of the model development stages?

Development phase	Time		
Defining objectives of the model development as well as system	None		
boundaries, stakeholders and issues of concern			
	Lots		
Selection of variables, processes, and indicators to include in the	None		
your model (and which temporal and spatial scale to model at)	Some		
	Lots		
Definition of management scenarios	None		
	Some		
	Lots		
Model set up (including selection of modelling approach,	D None		
development of model structure and parameterisation)			
	Lots		
Simulation and estimation of impacts	🗆 None		
	Some		
	Lots		
Evaluation of management alternatives	□ None		
	Some		
	Lots		
Report findings and their implications	D None		
	Some		
	Lots		
Comparison of alternatives and negotiation of trade-offs	□ None		
	Some		
	Lots		

# Appendix . Workshop evaluation surveys

A short survey was conducted on day 5 (Friday) to gain some feedback on the main components of the workshop and the Bayesian network (BN) methodology. 13 completed survey forms were obtained.

Usefulness and technical level of information presented in this workshop

### Feedback on the workshop

We are interested in your opinions of the usefulness and technical level of the information presented in this workshop.

. Please rate how useful the com	ponents of this workshop	o were for	you
----------------------------------	--------------------------	------------	-----

Benefit of workshop session											
Not beneficial	1	2	3	4	5	6	7	8	9	10	Highly beneficial
Not beneficial	1	2	3	4	5	6	7	8	9	10	Highly beneficial
Not beneficial	1	2	3	4	5	6	7	8	9	10	Highly beneficial
Not beneficial	1	2	3	4	5	6	7	8	9	10	Highly beneficial
Not beneficial	1	2	3	4	5	6	7	8	9	10	Highly beneficial
	Not beneficial Not beneficial Not beneficial Not beneficial Not beneficial	B Not beneficial 1 Not beneficial 1 Not beneficial 1 Not beneficial 1 Not beneficial 1	Ben       Not beneficial     1     2       Not beneficial     1     2       Not beneficial     1     2       Not beneficial     1     2       Not beneficial     1     2	Benefit         Not beneficial       1       2       3         Not beneficial       1       2       3	Benefit o         Not beneficial       1       2       3       4         Not beneficial       1       2       3       4	Benefit of v         Not beneficial       1       2       3       4       5         Not beneficial       1       2       3       4       5	Benefit of woNot beneficial123456Not beneficial123456Not beneficial123456Not beneficial123456Not beneficial123456	Benefit of workNot beneficial1234567Not beneficial1234567Not beneficial1234567Not beneficial1234567Not beneficial1234567Not beneficial1234567	Benefit of workshi           Not beneficial         1         2         3         4         5         6         7         8           Not beneficial         1         2         3         4         5         6         7         8           Not beneficial         1         2         3         4         5         6         7         8           Not beneficial         1         2         3         4         5         6         7         8           Not beneficial         1         2         3         4         5         6         7         8           Not beneficial         1         2         3         4         5         6         7         8	Benefit of workshop           Not beneficial         1         2         3         4         5         6         7         8         9           Not beneficial         1         2         3         4         5         6         7         8         9           Not beneficial         1         2         3         4         5         6         7         8         9           Not beneficial         1         2         3         4         5         6         7         8         9           Not beneficial         1         2         3         4         5         6         7         8         9           Not beneficial         1         2         3         4         5         6         7         8         9           Not beneficial         1         2         3         4         5         6         7         8         9	Benefit of workshop ses           Not beneficial         1         2         3         4         5         6         7         8         9         10           Not beneficial         1         2         3         4         5         6         7         8         9         10           Not beneficial         1         2         3         4         5         6         7         8         9         10           Not beneficial         1         2         3         4         5         6         7         8         9         10           Not beneficial         1         2         3         4         5         6         7         8         9         10           Not beneficial         1         2         3         4         5         6         7         8         9         10

Any comments:

2. Please rate the technical level of information presented during the workshop.

Component	Benefit of workshop session							1				
The role of	Too simple	1	2	3	4	5	6	7	8	9	10	Too technical
social science												
Modelling	Too simple	1	2	3	4	5	6	7	8	9	10	Too technical
process												
Hydrology	Too simple	1	2	3	4	5	6	7	8	9	10	Too technical
modelling												
Integrated	Too simple	1	2	3	4	5	6	7	8	9	10	Too technical
assessment and												
modelling												
Bayesian	Too simple	1	2	3	4	5	6	7	8	9	10	Too technical
networks												

Any comments:

3. Would you have liked more (or less) time on particular components of the workshop? If so, please specify which components.

4. Do you think you have more skills now to develop and implement integrated projects (Yes, No, Not sure)?



Would you have liked more (or less) time on particular components of the workshop? If so,	Do you think you have more skills now to develop and implement integrated projects (Yes, No, Not
please specify which components	sure)?
"Yes, I would. Look at modelling approaches for integration, sensitivity analyses and predictive accuracy"	Yes
"Yes, I prefer to know more on the role of social science and integrated assessment"	Yes
<i>"Focusing on the time [type / spent on?] of model"</i>	Yes
" I liked all activities because these show us the	Yes
real problems that I never think in theory learning"	
"Should set up workshop again and focus on BNs"	Not sure – "I get concept about integrated assessment and I have skills to do conceptual model and influence diagrams but I am not sure can use the tool (BNs) for getting the results that I need"
"Yes, I would have more time. I think them good to work"	Not sure – "I don't have enough time to develop and implement integrated projects and try to do them"
<i>"Hands-on session. It may use the default data to present the analysis"</i>	Not sure
"Integrated conceptual"	Yes
"appropriate time"	Not sure
"Yes, methods, step, sequence"	Yes
"I would like more [?] minutes"	Yes
"No"	Not sure

## Usefulness of the BN methodology



Do you believe that BNs could assist in research or decision-	Conceptual (1 –	Finished (1 – not
making within your organisation? Why / Why not?	not beneficial; 10 –	beneficial; 10 –
	highly beneficial)	highly beneficial)
		<i><i>o</i>, <i>,</i></i>
"Yes I do. Because it has many blocks that are used within my	7	7
organisation but I must find them before to do it."		
"I do believe that BNs can assist in research within my	9	9
organisation. Because BNs is a system holistic, we can get results		
about logic, policy and exploring causality between key factors		
impacting upon the adoption of management practices but I		
need more skill to develop and implement my project via use BNs		
for getting my final goal"		
של על העוצ הערובי לאו האיני איז איז איז איז איז איז איז איז איז אי	9	10
"Absolutely, because my job relating the analysis and BNs can	8	8
help me makina decision easier and aet all dimensions.		•
Furthermore. BNs also would bring me more ideas and create		
new researches"		
"Yes I do. Because my organisation have many sections of work	8	9
and each section have more data or research but we don't		
integrate. BNs is guideline and example for development our		
organisation."		
<i>"I believe that BN can help us to make decision on any project</i>	9	9
because BN use multiple sections for analysis e.g. social,		
economic, environmental"		
"Yes, I do believe that BNs can assist in any decision-making in	9	9
our organisation. Nowaday, my duty focus on hydrology data		
that is not focus of social module. We know integration methods		
is good for use but we are not exactly do it well. My opinion is		
BNs may be useful for use to support the decision-making"		
"Yes, I believe BNs can guideline us and BNs may support my	8	8
organisations decisions"		
"Yes, it is very useful for our work"	9	9
"Yes, I do, because it can tell how to decision"	6	8
"Yes, because my job about project planning that include public	5	4
relation. It can apply all data to program."		
"Yes I do because of the way of integrated conceptual before use	Highly beneficial	Highly beneficial
model and method to do in case"		
"Yes, it can use to overview the complex factors and define	9	7
relationships between them. Robust [method] for include[ing]		
different data structure"		

Appendix . Training photos Day 1: Opening ceremony, introductions and Phattaporn Mekpraksawong's presentation



Day 2: role of social science and good modelling practice



Day 3: introduction to integrated assessment



Day 3: group conceptual modelling exercise





Day 3: presentation of group conceptual models



Day 4: Turning the conceptual model into a Bayesian network model structure



Day 4: Training in the Netica software (building a model)



Day 4: Training in the Netica software (using a model and interpreting results)



# Day 5: Wrap-up



# Appendix . The Master Class Program

Day 1 (Monday 26 <sup>th</sup> October)			
Time	Description	Format	Presenters
08:30 - 09:00	Arrival and registration		
09:00 - 10:30	Welcome ceremony, overview and group		
10.00 11.00	introductions		
10:30 - 11:00	Morning tec	a .	
11:00 - 12:30	Session 1: IACM issues; introduction to IA	Lecture	ANU
12:30 - 13:30	Lunch	Testing tellesing	ANUL COLL
15:30 - 15:00 15:00 15:20	<u>Session 1:</u> National water Plan (RD) Lecture + discussion Alto, CSU		ANU, CSU
15.00 - 15.30	Afternoon tea		
15.30 - 10.00	<u>Session 2.</u> Maning catement management Day 2 (Tuesday 27 <sup>th</sup> Octobe		ANU, CSU
Time	Day 2 (Tuesday 27 Octobe)	Format	Presenters
08:45 - 09:00	Arrival	Format	1 resenters
09:00 - 10:30	Session 3: Social science, policy and governance	Lecture + O&A	CSU
10:30 - 11:00	Morning tee	a	
11:00 - 12:30	Session 3: Social science, policy and governance	Lecture + Q&A	CSU, ANU
12:30 - 13:30	Lunch		,
13:30 - 15:15	Session 3: Models and good development practice	Lecture + breakout group	ANU
15:15 - 15:30	Afternoon te	ea a a a a a a a a a a a a a a a a a a	
15:30 - 16:00	Session 3: Hydrology (+ water-related disciplines) Lecture + breakout group ANU		
Day 3 (Wednesday 28 <sup>th</sup> October)			
Time	Description	Format	Presenters
08:45 - 09:00	Arrival		
09:00 - 10:45	Session 4: Systems thinking & conceptual models	Lecture	ANU, ECU
10:45 - 11:00	Morning tec	a	
11:00 - 13:00	Session 4: Conceptual modelling tutorial	Tutorial	ANU, ECU
13:00 - 15:15	Lunch + free t	time	
15:00 - 15:30	Session 4: Conceptual modelling tutorial (continued)	lutorial	ANU, ECU
15:15 - 15:30	Afternoon te	Tutorial	ANUL ECU
15:50 - 10:00	<u>Session 4:</u> Conceptual modelling tutorial (continued)	i utoriai	ANU, ECU
Time	Day 4 (Indistay 27 Octobe Description	Format	Presenters
08.45 - 09.00	Arrival	Format	1 resenters
09:00 - 10:30	Session 4: Modelling approaches for integration	Lecture	ANU. ECU
10:45 - 11:00	Morning tee	a	
11:00 - 12:30	Session 4: Bayesian networks – Introduction &	Lecture	ANU, ECU
	Influence Diagrams		
12:30 - 13:30	Lunch		
13:30 - 15:15	Session 4: Influence diagrams tutorial	Tutorial	ANU, ECU
15:15 - 15:30	Afternoon tea		
15:30 - 16:00	Session 4: Bayesian networks – Data population and	Lecture	ANU, ECU
	evaluation		
T.	Day 5 (Friday 30 <sup>th</sup> October	•)	D
<b>Time</b>	Description	Format	Presenters
08:45 - 09:00	Arrival	Trate vial	ANUL ECU
10:20 - 10:30	Session 4: Data population and evaluation tutorial		ANU, ECU
10.30 - 11.00 11.00 - 11.30	MORNIng lea		
11.00 - 11.50 11.30 - 12.00	Session 5: Benefits and challenges of IACM	Presentation and group	Participants
11.50 - 12.00	bession 5. Denents and enalitinges of IACM	discussion	1 articipants
12:00 - 13:00	Session 5: Concluding talk by RID director and Dr		
12.00	Vanida Khumnirdpetch (Roval Thai Embassy) and		
	presentation of certificates to workshop participants		
13:00 - 14:00	Lunch and farewells		

# Day 1 (Sessions 1 and 2)

Following the welcoming ceremony and introductions a presentation introducing the concept of Integrated Assessment (IA). Topics covered included

- An overview of the need for integrated approaches using, as examples, issues around agricultural intensification, sustainable development goals, water-food-energy nexus and the conjunctive use of surface and groundwater resources
- Introduction to the process of integrating knowledge from various disciplines (e.g. social science, economic, hydrology, environment) to investigate and evaluate complex management issues
- Introduction to key decision making concepts (namely risk assessment, decision making under uncertainty). We undertook a mapping exercise in this session to understand the range of disciplinary backgrounds, roles and responsibilities and modelling expertise within the group (see Appendix 4).

After lunch, Phattaporn Mekpraksawong gave a presentation on the latest Thailand National Plan of Water Management which details six broad water management goals each with a number of strategies to achieve the goals:

- 1. *Water consumption management:* providing clean water for consumption to community to cover all villages and cities including exclusive economic zones and important tourist attractions
- 2. *Water security for agriculture and industry:* decrease water 'loss' from agriculture and secure suitable supply of water for industry
- 3. Flood management: reduce damage from flooding in urban, agriculture and high risk village areas
- 4. Water quality management: maintain or achieve fair to good water quality resources across Thailand
- 5. *Reforestation & soil rehabilitation:* restore forest area to 40% of county areas and prevent soil loss from agricultural areas
- 6. *Increase management efficiency:* three tier approach involving (a) the country water data center, (b) organisation, law and regulation, and (c) public relations and participation.

The presentation provided context for the remainder of the workshop with the Session 3 and 4 tutorial tailored to ensure relevance to the National Plan and participants' work roles.

The last part of day 1 covered the short session 2 (*Framing catchment management problems*). This session introduced some of the key concepts referred to or expanded up throughout the workshop: uncertainty and decision-making, adaptive management and systems thinking, and the role of both social science and modelling in informing and supporting decision-making.

# Day 2 (Session 3)

The purpose of day 3 was to provide some disciplinary background for later activities; we focused on social science, good practice model development and modelling hydrology (and related disciplines).

The presentation by Professor Allan Curtis on social science focused on

- Social Impact Assessment
- Key social science concept including values, beliefs, norms, attitudes, institutions and policy option, trust and social capital
- Community type frameworks that can be used to identify stakeholders
- The types of policy options available to change stakeholder behaviour

The activities developed for the workshop (see below) drew on Phattaporn Mekpraksawong's presentation from the previous day. Due to time constraints, the 'trust and trustworthiness' activity was a take-home activity and not conducted in group setting.

Activity: Social Impact Assessment	Activity: Engaging farmers	
<ul> <li>Topic 1</li> <li>Proposal to reforest 40% of the farmland in an upland watershed in Central Thailand to reduce flooding of downstream urban areas.</li> <li>Topic 2</li> <li>Proposal to build a dam on a major river to provide hydro electricity to support a large new industry intending to establish in a large Thai city.</li> <li>Work in pairs to answer Qs1&amp;2 for each topic.</li> <li>1. Who are the stakeholders affected by the proposal?</li> <li>2. What are the likely social impacts of the proposal?</li> </ul>	Topic Decision made to improve water use efficiency (WUE) by 25% over 5 years amongst farmers in the "rice bow!" so that additional land can be irrigated. Work in groups to address Qs1-3. Question 1 Identify the key WUE options (say 5) that are available today. Question 2: Assess the extent farmers would adopt each WUE option without support. Briefly explain your assessment.	
As a group discuss responses to Qs 1-2 and consider Q3. 3. How might the key impacts be ameliorated/ reduced?	Utestion 3: If the Thai Government decided to accelerate adoption of these WUE options, which mix of policy instruments would your Department advise for WUE options 1-3?	
Activity: Describing social structure	Activity: reflecting on trust and trustworthiness	
Select a rural district where you have worked in the past to implement a project or program. Question 1 Draw on the capitals and well-being frameworks and the topics provided in the Australian examples to describe the key characteristics of the social structure in your district at the time of your project. If your project was more than 5 years ago, what are the current trends in that district?	<ul> <li>Working on your own:</li> <li>Reflect on the extent that the partners or potential partners of your organisation have made judgements of the trustworthiness of your organisation and those assessments have affected project or program outcomes. If you can, identify examples where those judgements have been positive and examples where they were progrative</li> </ul>	
Question 2 Explain how those characteristics (i.e. social structure) influenced the way you/ your team approached engagement or was able to successfully engage with farmers/ other stakeholders.	<ol> <li>Select an example where the judgements of trustworthiness were negative and think of how that situation might have been improved. You should consider the 3 elements of trustworthiness.</li> </ol>	
Work in small groups of three Share your descriptions and explanations for Qs 1&2. Then discuss how social structure can be considered when developing future projects in your Department.	Now share one example of positive judgements of trustworthiness (verbally) with one other person in your group. Also reflect on the reasons why trustworthiness was important and how it was built.	

Only two of the eighteen survey respondents (in Appendix 4) noted prior experience in collecting or analysing socio-economic data. During discussions during the session (and in Session 5) several respondents expressed an appreciation for the content in this component of the workshop. Some said they had recognised the importance of involving stakeholders and considering social impacts of their institutions' policies on communities, but had not known how to think about the social aspects of (or incorporate them into) their work. This component was well-rated by all participants in the evaluation survey conducted on day 5 in terms of usefulness and, relative to other components, the technical level of information (Appendix 5).

The afternoon of Day 2 focused on model development process; the planned hydrology component was reduced in its technical detail and length. The presentation by Professor Tony Jakeman on 'good modelling process' was well received although some participants reported that the material was too technical (Appendix 5). Within the group, there was greater familiarity with modelling and aspects of hydrology modelling and data analysis, reflecting many of the participants were actively working in the irrigation, flood control and water supply sectors. This, and the limited time spent on hydrology, may explain the lower score some respondents gave to this component. If this Masterclass was to run again we would revise the material in the modelling component of Session 2 to reduce the technical detail and increase the interactivity through (e.g.) group activities or simple tutorials.

# Day 3 (Session 4)

Session 4 was the main component of the workshop and was split over three days; the session was copresented and facilitated by Wendy Merritt and Serena Hamilton. On Wednesday (Day 3), the focus was on (a) introducing integrated assessment (IA) and the commonly used types of IA models and (b) developing skills in systems thinking and conceptual modelling. The day concluded with an introduction to the BN methodology which was used as the basis for the next days activities.

Dr Serena Hamilton drew on Phattaporn Mekpraksawong's presentation to introduce participants to integrated assessment and the different dimensions that need to be considered in integrated approaches to water management (in the Thai context).



[Above] The ten dimensions of integration and their relevance to the Thailand National Plan of Water Management (Adapted from Hamilton et al. (2015) Integrated assessment and modelling: Overview and synthesis of salient dimensions, Environmental Modelling and Software, 64, 215-229)

A strong focus was given to systems thinking and development of conceptual models; regardless of the type of model applied to water resource management, all modelling projects can benefit from early scoping and conceptual modelling phases. Three groups of participants each developed conceptual models for a management issue where the objective was to 'develop a robust policy to protect a water or policy sector (e.g. agriculture or domestic water supply) against drought and water scarcity'. During this exercise, participants discussed within their group some or all of the following

- The issue: e.g. water allocation, irrigation planning, farming
- The stakeholders
- Spatial scale: e.g. Chao Phraya River basin, Khon Kaen River, stream reach, village
- Temporal scale (or management timeframe): e.g. season, annual, long-term
- *Key variables to include:* inputs (controllable management actions and/or uncontrollable drivers), intermediate social or biophysical processes or behaviour, and outcomes
- Causal links: relationships between variables

At the end of the exercise, each group presented their conceptual model to the whole group (See below and photographs in Appendix 6). This component well received by the participants who appeared to enjoy the greater emphasis on practical group exercises (Appendix 5).

Chi River Basin – Irrigation Area Chaophraya Basin (Agriculture)

Chaophraya Basin (Domestic use)



# Day 4 (Session 4)

Bayesian networks were used as the basis for Day 4 activities as it is a commonly used approach in integrated modelling that is relatively easy method to start learning and building models and is a flexible approach that can draw on qualitative and incomplete information. In that sense, the group could start to build preliminary models for issues of relevance to their work without the need to have data ready for the workshop.



The model development process for BNs was presented with key components followed by tutorials. Firstly, Dr Serena Hamilton conducted a tutorial demonstrating how to build a BN and populated it with data using the Netica software. The groups then developed the model structure (influence diagram) based on the previous day's conceptual modelling exercise, either on paper or using Netica.



## Day 5 (Sessions 4 and 5)

The Session 4 activities concluded before morning tea on Day 5 with a tutorial on performing sensitivity analysis and scenario analysis on completed BN model. Using a case study on adoption of riparian management practices in Tasmania, Australia, participants explored causality between key factors impacting upon the adoption of riparian management practices, undertook sensitivity analyses and explored the impacts of data limitations on BN models.

After morning tea, the workshop concluded with Session 5. After a brief overview of workshop activities by Wendy Merritt, Mr Chanin Songchon gave a presentation on the workshop learnings on behalf of the participants. This was followed by a group discussion in Thai (and translated to English) around the benefits and challenges of integrated assessment approaches and the Bayesian network methodology to their work. Participants could see the need for more integration between different Offices within RID and other departments (e.g. Department of Water Resources and Department of Land Development) and spoke of integrated assessment being a potential way forward. As this workshop was an introduction to IA methodologiesh and the BN approach in particular, some participants identified that the next step would be to identify a real-world project (with funding), drawing on the expertise across multiple agencies, that could be used as the basis for advanced (and practical) training in the methodologies. A current barrier to adoption of these methodologies might be the time and resources (funding and personnel) needed which are not reflected in peoples current work load. The session concluded with talks by the RID director and Dr Vanida Khumnirdpetch (Royal Thai Embassy) and presentation of certificates to workshop participants.