CONNECTED CATCHMENTS

Workshop Notes – Friday 14 June

ABSTRACT

Connecting the landscape processes across different modelling scales from the top to the end of catchment

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June 2019

QUEENSLAND WATER MODELLING NETWORK

Overview of this workshop

The skills to build connectivity in the hydrological flows of water have underpinned the development of various water modelling platforms.

The focus of water quality outcomes in Queensland however is proving to be a more challenging process to link water models developed at different scales and better understand how the flow of sediment and other exported pollutants is being generated across the inter-connected catchment landscapes.

A focus of improved management practice and reduce sediment and pollutant export is certainly a focus in Great Barrier Reef catchments, though is equally relevant in all other catchments in Queensland. So when water models are being used to underpin both monitoring and investment ranking how can a high confidence, by both water modellers and management/policy practioners, be achieved when using an inter connected system of models.

Advice from key modelling practioners has identified that there is a need to build a modeling framework that assist both modelers and users of the outputs to better appreciate this connectivity. What this is and what its utility might be was the focus of this QWMN Community of Practice workshop, where the aim was to:

- Clarify the challenges in connecting water models across different scales
- Identify the ramification of improved connectivity for policy and management uses
- Propose a process/steps to build a set of guiding principles that would allow model connectivity to be both achieved and implemented

In offering this event we were able to attract the interest of colleagues[1] from:

- Local Government
- State Government
- Research
- Consultants
- Water Utilities
- Regional NRM bodies

What follows are the responses to various questions from three small groups:

Scene setting and context

Key messages:

Brian Stockwell – Noosa Shire Council:

- It is important to use models considering the context of the catchment. Don't just believe the numbers.

Paul Maxwell – Healthy Land & Water:

- Having the data to validate modelling predictions and calibrate the models is a challenge.
- There is a challenge in addressing local issues and define local catchment actions when using regional models.
- Collaboration is key to improve modelling capacity.

[1] List of participants is in Appendix 1

Rob Ellis - DES:

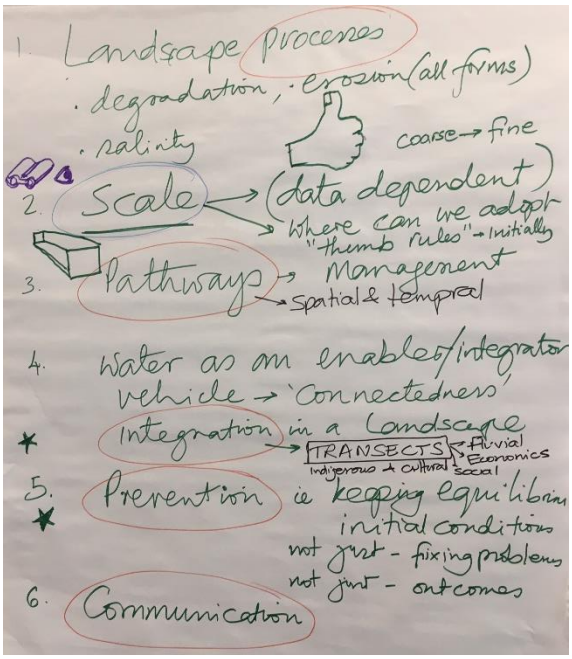
- It is important to combine modelling information and local knowledge.
- There are scale-related issues when undertaking monitoring.
- Catchment issues (e.g. sedimentation, nutrients) need to be looked at together, rather than independently.

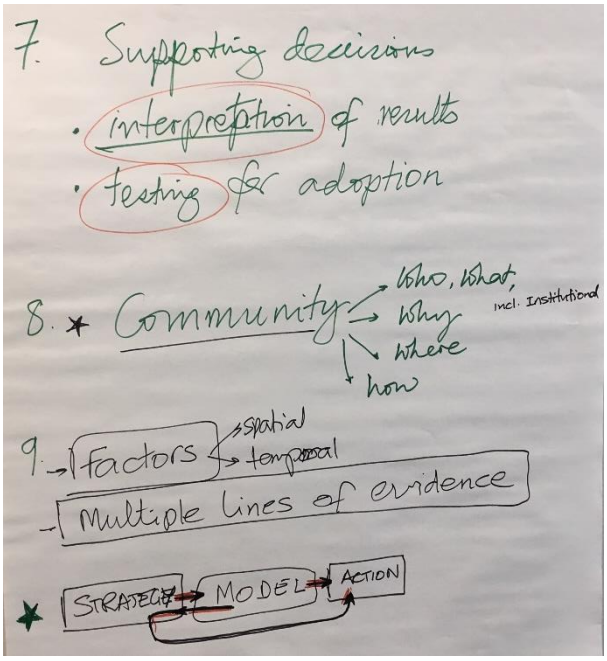
Question 1 – What are the issues associated with connectivity across a catchment?

Key messages from the collective groups feedback:

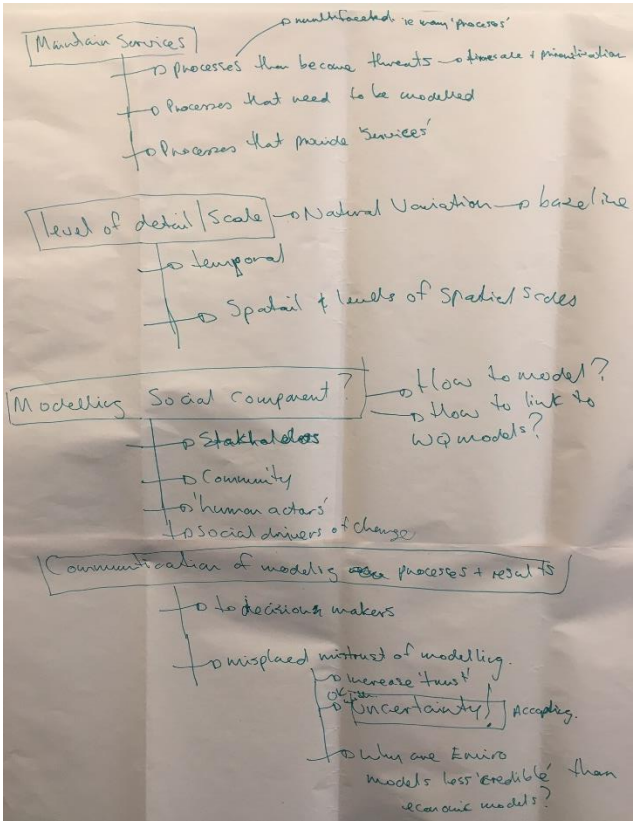
- It is important to acknowledge that catchments are dynamic, and static guidelines might not be the best way to measure outcomes.
- The is a challenge on how to model the social components of catchments, or to influence behaviours of stakeholders through modelling.
- Social dimensions pose threats and opportunities for model-informed decision making. How do we incorporate these into water modelling is unclear?
- In comparison to economic models, water models lack trust from decision makers, who are not comfortable with the uncertainty levels these offer… but economic models are not that different. How can we become comfortable with this uncertainty?
- It is important to marry models with the understanding of the social, environmental, economic context. Even when using rules of thumb instead of models, this understanding is key. Models / rules of thumb shouldn't be the problem, as these are meant to support our understanding of the issue to get action on the ground.
- COMMUNITY is the missing piece.

Group 1

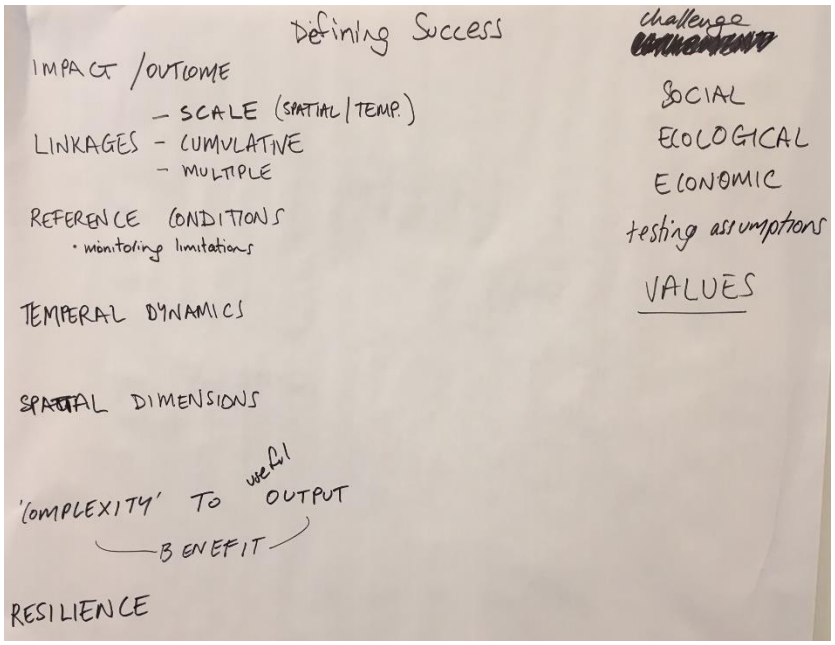




Group 2



Group 3

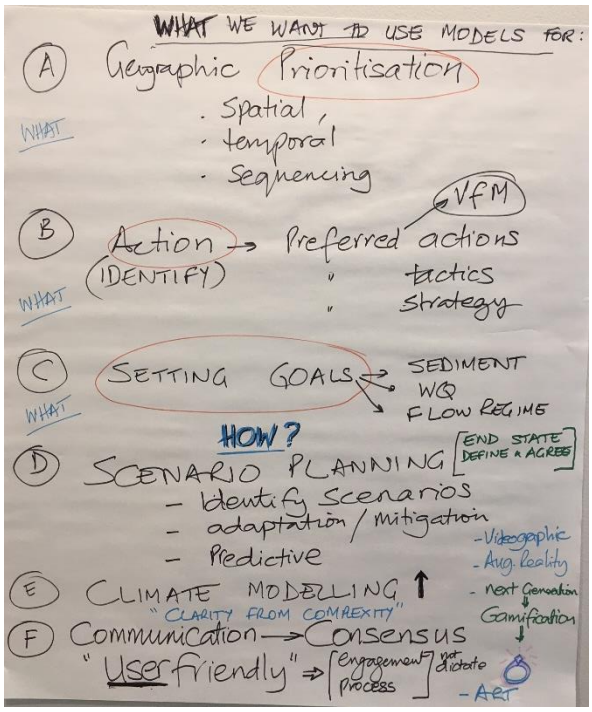


Question 2 – What are the modelling and landscape management implications?

Key messages from the collective groups feedback:

- There is a need for models to better connect to catchment processes, but is it about the outcomes of catchment processes (i.e. what ends up at the receiving water body) or the "movements" of these processes?
- Prioritising of issues, depending on the context, is key (i.e. where and when, and what issues? How do this integrate?)
- It's important to clarify the purpose of models: are models showing us where should we be? Or how to get where we want to be?
- Communication/engagement is key, especially when models are too complex.
- How do we link water models with climate modelling?
- The capacity of models to bring clarity around issues is more important than their capacity to represent high levels of complexity. This is important for their role in supporting engagement
- The issue of connectivity is not just about the catchment's biophysical processes, but also about its socio-economic elements.
- These connections are not yet well defined.

Group 1



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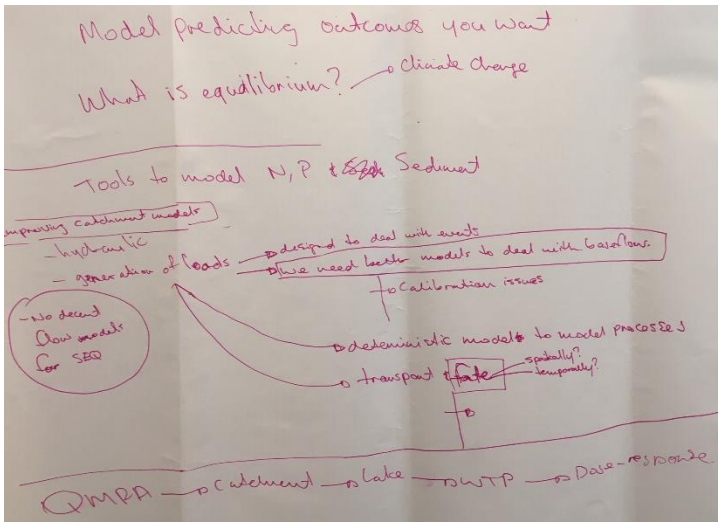

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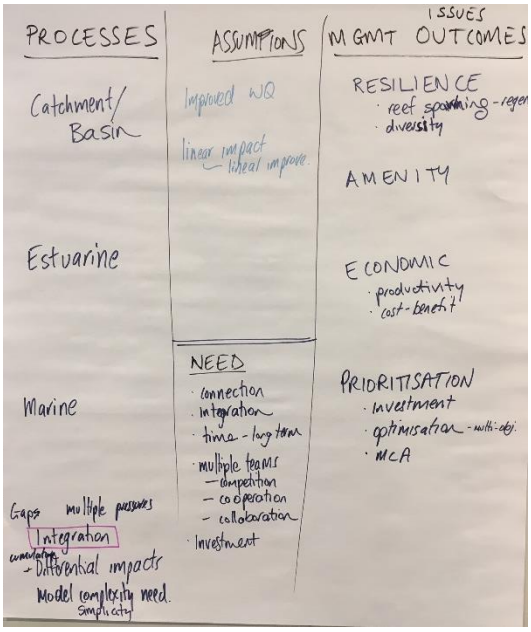


Question 3 – What are the next steps to progress the integrated building of models to better connect processes across catchments?

Key messages from the collective groups feedback:

- **Group 1**
  - Immediate
    - Need to better connect model questioners, and enable more efficient collaboration.
    - Need to connect the processes in the models across scales (from too course to too fine)
  - Later
    - How to integrate with climate modelling
    - Interconnections between water, vegetation and other models.
    - Need for enhanced Involvement of stakeholders to be impacted by model-informed actions (e.g. through “charade” processes, the "AIM" process, etc.)
    - When bringing models and questioners together, the narrative of the "Why" is really important.
    - Lucy: 1. Connecting questioners of similar questions in the same place. 2. Connecting processes in models – which parts are connected and influence other decisions. NRM – needs a systemic regional plan. 3. Involve those who will be affected to have more legitimacy.
    - Abel: What can we create together?

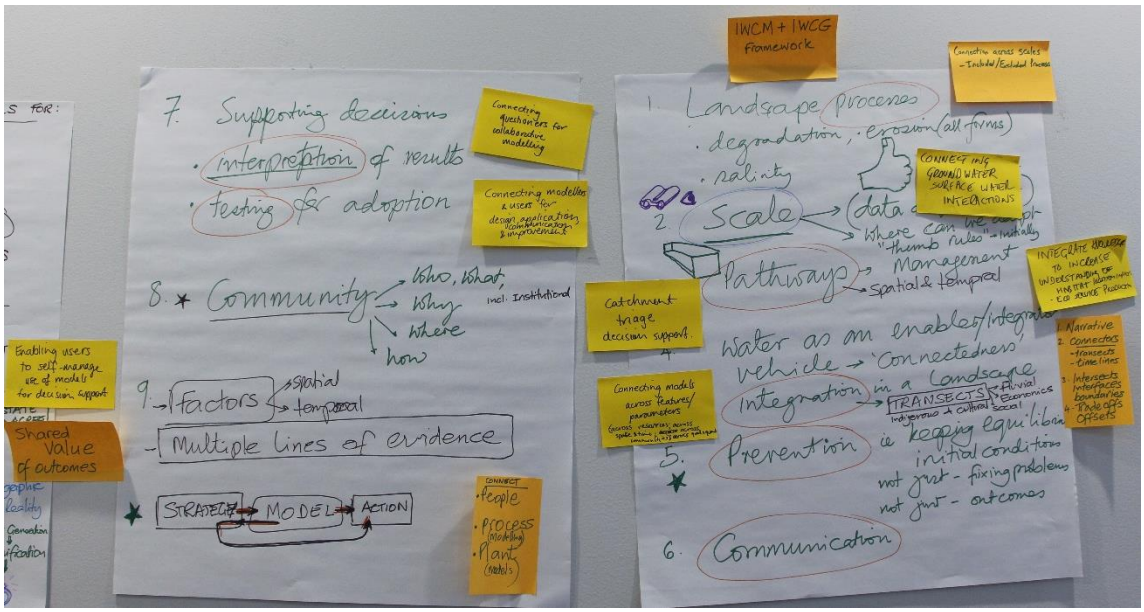
- **Group 2**
  - Connection between catchment and estuarine components. What at the processes in between these? E.g. What are the erosion and deposition zones within these?
  - Connect models across scales (e.g. urban with catchment)
  - Cost benefit analysis? Who cares and do we need to care… what is the point? The question revolved around whether or not investing in more research had a benefit (eg. Investing 2 billion in research to obtain a 500K benefit). So, the cost implications of management decisions… If knowing more would actually change the management.
  - Knowing what data is needed and how to source it properly is an issue, especially when finding where are the hotspots for actual/impactful actions. Locally specific information is required for locally specific actions.
  - Connecting events in upper-catchments and how far the impacts go down the landscape.
  - Need for better transfer of knowledge across experiences.
  - Hotspots for action change depending on where you are in a catchment and what are the particular community values in that area.
  - Water is what links all models (floods, groundwater, catchments, environment, etc.)

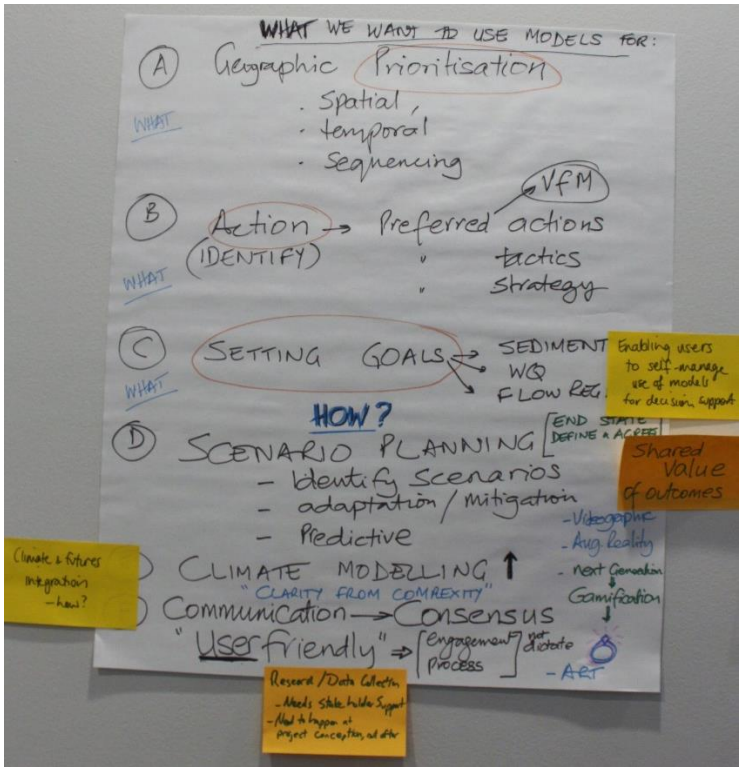
- **Group 3**

  - Need to better articulate what assumptions are being taken when using models.
  - what are the assumptions, what is driving the assumptions? There is a need to define them.

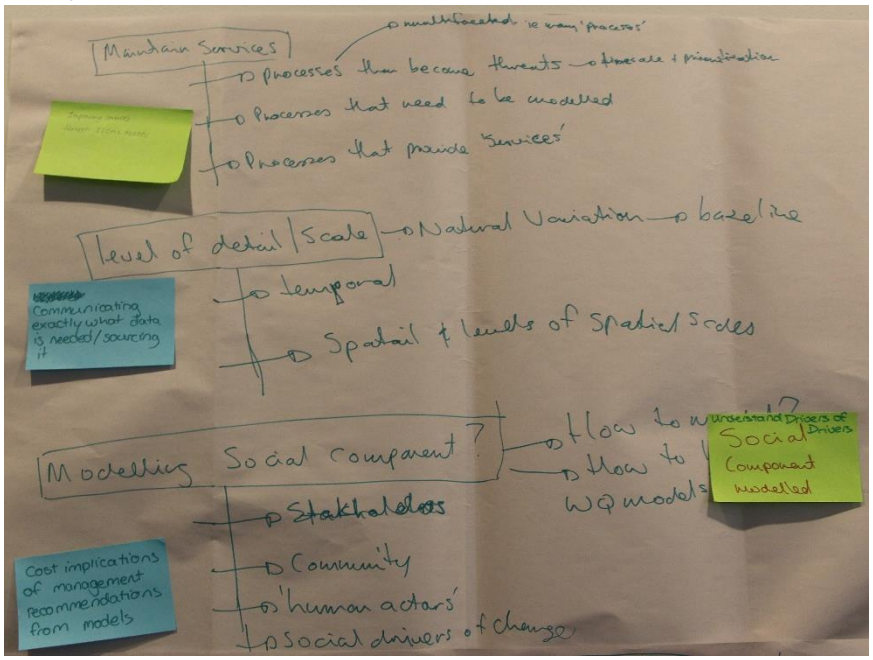
- Need to better understand what the sensible boundaries of models are, what is linkable between/across them, and what is redundant when doing so. This is important to inform how different groups can start working more collaboratively. And to know where can the assumptions be applicable
- There is a need for an enhanced ability to tell the story… turn model outputs into something relevant for politicians
- Need for a model map to know where to head, mega data, available and with clear visual.
- Uncertainty around models: we need to not just be able to communicate it, but also to embrace it and be more comfortable with it. Important lessons can be drawn from the economic modelling sector.
- Rather than making all models fit together (e.g. in a super-model), we need to be able to find what is needed from each model. When it comes to actual actions, there is only so much we can do (given our we have limited tools).

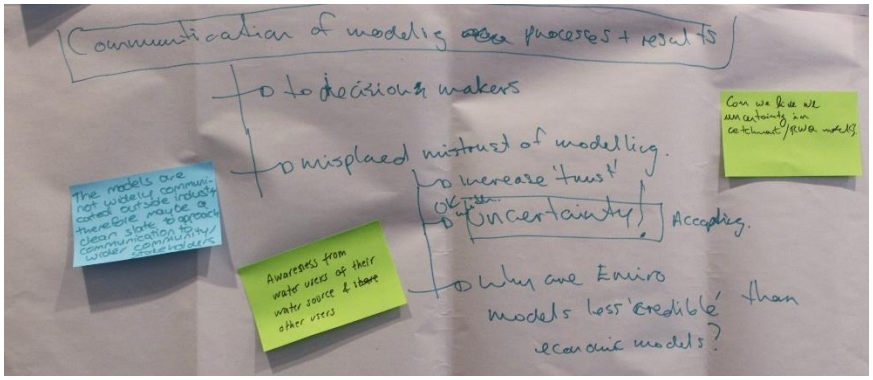
Group 1

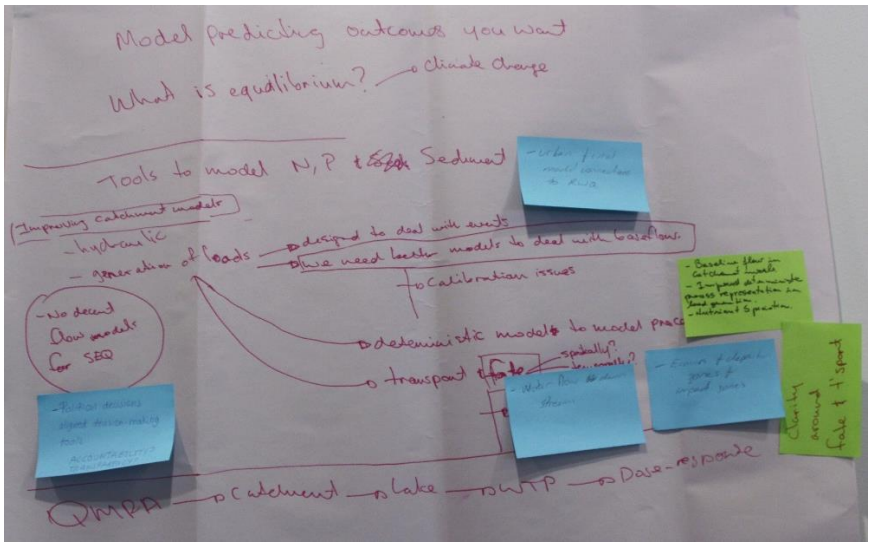



WHAT WE WANT TO USE MODELS FOR:
A Geographic Prioritisation
WHAT
. Spatial,
. temporal
. Sequencing
VfM
B Action → Preferred actions
(IDENTIFY)
" tactics
" strategy
WHAT
C SETTING GOALS → SEDIMENT
WQ
FLOW REG.
Enabling users to self-manage use of models for decision support
WHAT
HOW?
D SCENARIO PLANNING [END STATE DEFINE & AGREE]
- Identify scenarios
- adaptation / mitigation
- Predictive
Shared Value of outcomes
- Videographic
- Aug. Reality
- next Generation
Gamification
Climate & futures integration - how?
CLIMATE MODELLING
"CLARITY FROM COMPLEXITY"
Communication → Consensus
"Usefriendly" ⇒ [Engagement process]
- ART
Research / Data Collection

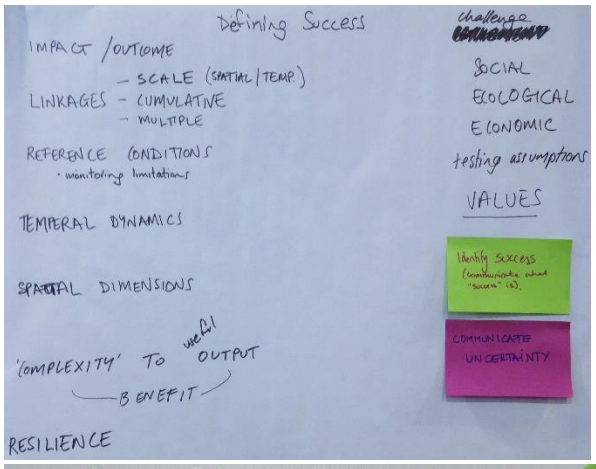
Group 2


Maintain Services
Processes that become threats → timescale + prioritisation
Processes that need to be modelled
Processes that provide 'Services'
level of detail / Scale → Natural Variation → baseline
temporal
Spatial + levels of spatial scales
Communicating exactly what data is needed / sourcing it
Modelling Social Component?
Stakeholders
Community
'human actors'
Social drivers of change
Cost implications of management recommendations from models
Social Component modelled


Communication of modeling processes + results
to decision makers
misplaced mistrust of modelling.
increase 'trust'
uncertainty!
Accepting.
Why are Enviro models less 'credible' than economic models?
The models are not widely communicated outside industry therefore maybe a clean slate to approach communication to industry/ wider community/ stakeholders
Awareness from water users of their water source & share other users
Can we have we uncertainty in catchment/RWQ models.


Model predicting outcomes you want
What is equilibrium?
Climate change
Tools to model N, P & Sediment
Improving catchment models
hydraulic
generation of loads
designed to deal with events
we need better models to deal with baseflows
calibration issues
deterministic models to model processes
transport
spatially?
temporally?
No decent flow models for SEQ
QMPA
Catchment
Lake
DWTP
Dose-response
Clarity around fate & transport

Group 3


Defining Success
IMPACT / OUTCOME
- SCALE (SPATIAL / TEMP.)
LINKAGES - CUMULATIVE
- MULTIPLE
REFERENCE CONDITIONS
· monitoring limitations
TEMPERAL DYNAMICS
SPATIAL DIMENSIONS
'COMPLEXITY' TO useful OUTPUT
BENEFIT
RESILIENCE
challenge
SOCIAL
ECOLOGICAL
ECONOMIC
testing assumptions
VALUES
Identify success (communicate what 'success' is).
COMMUNICATE UNCERTAINTY


PROCESSES
MGMT ISSUES OUTCOMES
MAKING SURE ALL ASSUMPTIONS ARE DETAILED
IS COUPLING MODELS NEEDED OR DO WE JUST NEED TO UNDERSTAND WHAT IS RELEVANT AT EACH SCALE
Model impact
Catchment/ Basin
Improved WQ
linear impact
lineal improve
Identify boundaries for dif problems/int.
RESILIENCE
· reef spawning - regen.
· diversity
AMENITY
- MULTIPLE STRESSORS
SEDIMENTS + NUTRIENTS + PESTICIDES + CLIMATE CHANGE
- Bring people & ideas together
- Simplicity
Estuarine
WORKING COMPARTMENT WITH UNCERTAINTY
TESTING PERTINENCE OF SOLUTIONS
ECONOMIC
· productivity
· cost-benefit
- A common modelling platform
- community model development
Marine
NEED
· connection
· integration
· time - long term
· multiple teams
- competit
- cooperat
- collaborat
· Investment
PRIORITISATION
· Investment
· optimisation - multi-obj.
MCA
MULTIPLE DISCIPLINES
PHYSICO-CHEMICAL
ECOLOGICAL
SOCIO-ECONOMICAL
PRIORITISATION
- MCA
SOCIAL / ECONOMIC / ENV.
CULTURAL dimensions
Gaps multiple pressures
Integration
cumulative
- Differential impacts
Model complexity need.
simplicity
GAMING SCENARIOS
- TIMELY
- COLLABORATIVE
MULTIPLE OBJECTIVES
- WATER QUALITY
- CULTURAL DEMOSTRATION
- ECONOMICS
Scale connection
- temporal
+ spatial
Long term collab
b/t model developers / scientists (impact assessment) + decision-makers
MULTIPLES SCALES (COHESION).
→ Paddock to reef
→ Short term - long term
UNDERSTANDING WHAT WE CAN MEASURE? WHAT WE CAN'T MEASURE.
UNDERSTANDING WHAT TO MEASURE/MONITOR?

Wrap up and follow up actions

Agreed needs:

1 - Better appreciate the various approaches in catchment connections in place. Aspects include

- Utilise/Build a platform or descriptive mechanism to describe the suite of efforts underway described on the workshop that depicts efforts up and down a catchment

- It would be useful to have a diagrammatic conceptualisation of what models are and want to be, and what elements come in place.

- Mapping of interactions between/across initiatives and models would be difficult to do from only one perspective. It may be that this mapping is done by different parties and the map grows as a network effort. QWMN could have a role in facilitating/funding this process. It is important to decide what would be the best way to represent it: is it from a hydrological cycle perspective?

Action – As an example of what is possible, Melanie Roberts is willing to share a draft of tool in Presi that she is developing. This draft version it is not for further distribution, just for the group's awareness, https://prezi.com/p/oscioisfww7l/test/

2 - There are opportunities for cross-learning between GBR - SEQ – MDB experience

Action – Southern Catchments are in the process of developing the basis for their forthcoming NRM plan – support via modelling tools and insights is being welcomed from Lucy Richardson

3 – What would a connected catchment from a modelling for management initiative look like?

Action – Paul Maxwell to share a draft proposal being developed for SEQ waterways

4 – Other issues raised

- Competition/diversity of approaches may be important too, but with clear game/ground rules, and cross-learning across different models/assumptions.
- There are lessons to be drawn from the economists, with regards to scale (macro versus micro), but also regarding how to we do a good articulation of outcomes.
- Models are not meant to be perfect!

Appendix 1 - Participants who registered for the workshop

First Name	Surname	Job Title	Company
Kelly	Mckendry	Water Resource Engineer	AquaIntel
Daniel	Botelho	Principal Engineer	BMT
Chantal	Donnelly	Head of Water Resource Modelling	Bureau of Meteorology
Andy	Wyer	Director / Senior Project Advisor	Core Project Advisory
Alexandra	Garzon-Garcia	Senior Scientist - Catchment Riverine Processes	DES
Rob	Ellis	Chief Modeler	DES
Dave	Waters	Chief Modeler	DNRME
Melanine	Roberts	Senior Research Fellow	Griffith University
Paul	Maxwell	Chief Scientist	Healthy Land & Water
Mark	Pascoe	CEO	IWC
Pablo	Orams	Senior Project Officer	IWC
Piet	Filet	Engagement Collaboration Specialist	IWC
Elise	Allely-Ferme	Event Photographer	IWC
Lucia	Gamarra	Event Project Officer	IWC
Evan	Thomas	A/ Science Leader	Landscape Sceinces
Cherie	O'Sullivan	Environment Officer	Noosa Council
Brian	Stockwell	Councillor	Noosa Shire Council
Chris	MacGeorge	Senior Hydrometeorologist	QIT Plus
Abel	Immaraj	Director	RW&A
Andrew	Smolders	Catchment Scientist	Seqwater
Lucy	Richardson	Senior Project Officer	SQ Landscapes
Ben	Jarihani	Senior research Fellow	University of the Sunshine C
Afshin	Ghahramani	Research fellow	USQ
Luke	McPhail	Snr IWM Specialist	Water Technology

Banded participants were unable to attend