

THE FE²W NETWORK

Review 2014-2018
Outlook 2019-2022

UNDERSTAND RISKS

ENGAGE DECISION-MAKERS

ENABLE ACTION

We enable decisions that improve livelihoods & sustain resource access

ABOUT US

Global risks across food, energy, environment, and water systems are multiplying. As the world's population surges towards 9.7 billion people by 2050, the demand for scarce resources increases and conflict over access intensifies



Cascading failures can move across countries and continents rapidly

Extreme weather events, urbanization, and rising food demand are among the many threats weakening the capacity of societies to provide basic human needs and prevent crises

The World Economic Forum has recognised that water scarcity, environmental degradation, and food shortages are generating major social and economic risks

The Sustainable Development Goals have articulated a vision to build resilience and meet global resource challenges

BUT RECOGNITION, VISIONS, TALK, AND MEASUREMENT ARE NOT ENOUGH

The complex global linkages between natural, economic, and social systems generate systemic risks

WE NEED TOOLS AND PRACTICAL SOLUTIONS, NOT JUST ASPIRATIONS AND WORDS

The Food-Energy-Environment-Water (FE²W) Network was created in 2014 to move the world beyond observation and visions to acting on the systemic risks to the critical resources all people need to live. Our members come from around the globe and work at universities, multilateral organisations, and non-government organisations.

From ministers to business leaders to farmers, we work with decision-makers to manage risks, support livelihoods, and increase the resilience of food, energy, water, and environmental systems. **We understand how the world works and we enable decision-makers to fix it.**

The FE²W Network has developed and tested the Risks and Options Assessment for Decision-Making (ROAD) process. ROAD is a participatory, systems-based approach to assessing and addressing complex risks. It provides a structure to devise portfolios of management options, prioritise cost-effective investments, and avoid maladaptation and poor decisions. The Global Food and Water System (GFWS) Platform is an online tool for exploring food-water linkages to 2050. We will continue to develop these tools and new ones to support decision-making.

The FE²W Network is ready to work with you on addressing existing and emerging risks

Claudia Ringler
Chair

Quentin Grafton
Director



50% INCREASE IN GLOBAL WATER DEMAND
60% INCREASE IN GLOBAL FOOD DEMAND
projected for 2014 to 2050



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**RISK-INFORMED
DECISIONS FOR A
SAFER WORLD**”

We are leading experts on
food-energy-environment-water systems

WHAT WE DO

Provide world-class scientific and economic analysis

Custom design and deliver risk assessments

Facilitate genuine stakeholder engagement

Monitor and evaluate outcomes

CLIMATE CHANGE **WATER CRISES** **ENERGY SECURITY** **BIODIVERSITY LOSS** **PRICE SHOCKS**
SANITATION ACCESS **POLLUTION** **GENDER INEQUALITY** **EXTREME WEATHER** **PLANT DISEASE**



WE ENABLE BETTER DECISION-MAKING ACROSS A RANGE OF CRITICAL THREATS AND SHOCKS



SCOPE

Identify risks, stakeholders & management options



DESIGN

Custom design risk assessment to needs & resources



FACILITATE

Conduct participatory processes & engage stakeholders



MODEL

Undertake quantitative scientific & economic modelling



ANALYSE

Qualitative & quantitative analysis of decision options



COMMUNICATE

Develop strategies to share analysis & decisions

We work with **government agencies**, **businesses**, **multilateral institutions**, **non-government organisations**, and **communities**

to

Address risks across all levels of governance and decision-making

OUR TEAM



CLAUDIA RINGLER

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Agricultural Policy | Resource Modelling



QUENTIN GRAFTON

AUSTRALIAN NATIONAL UNIVERSITY

Water & Energy Economics | Resilience



DUSTIN GARRICK

OXFORD UNIVERSITY

Water Governance | Political Economy



PAUL WYRWOLL

AUSTRALIAN NATIONAL UNIVERSITY

Hydropower Economics | Systemic Risks

NETWORK MEMBERS



Our 40 members are researchers and practitioners from universities, government agencies, and non-government organizations across the world



NAZMUN RATNA

LINCOLN UNIVERSITY

Development & Diversity Economics



PAMELA KATIC

UNIVERSITY OF GREENWICH

Quantitative Socio-Economic Analysis



THANG DO

AUSTRALIAN NATIONAL UNIVERSITY

Environment Policy | Development



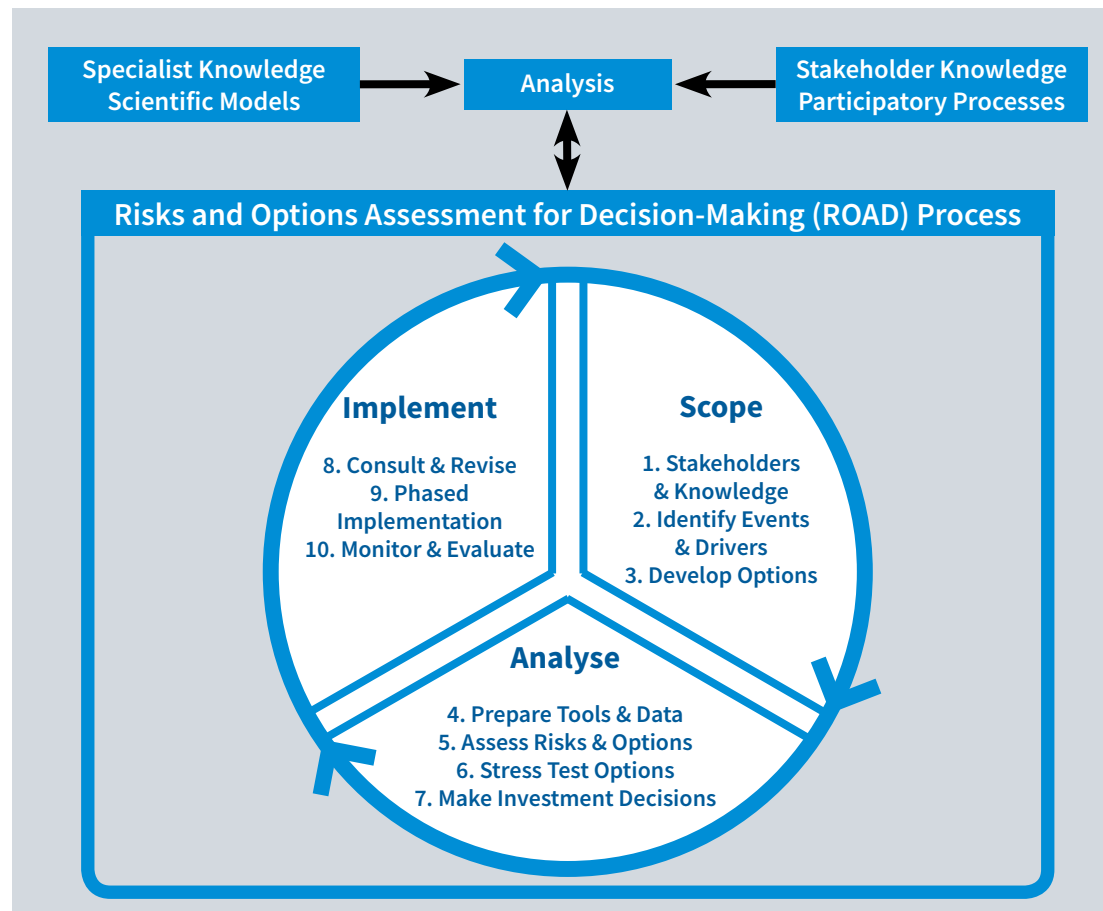
SARAH WHEELER

UNIVERSITY OF ADELAIDE

Agricultural Economics | Water Markets

ROAD PROCESS

The Risks and Options Assessment for Decision-Making (ROAD) process is a participatory tool for understanding risks and assessing alternative management options. ROAD is an iterative process that breaks down complex risks into system components and enables analysis of decision outcomes. This causal, systems approach supports resilient & sustainable decision-making under uncertainty



The 10 steps in the ROAD process encompass the complete decision-making process, from scoping to outcome evaluation

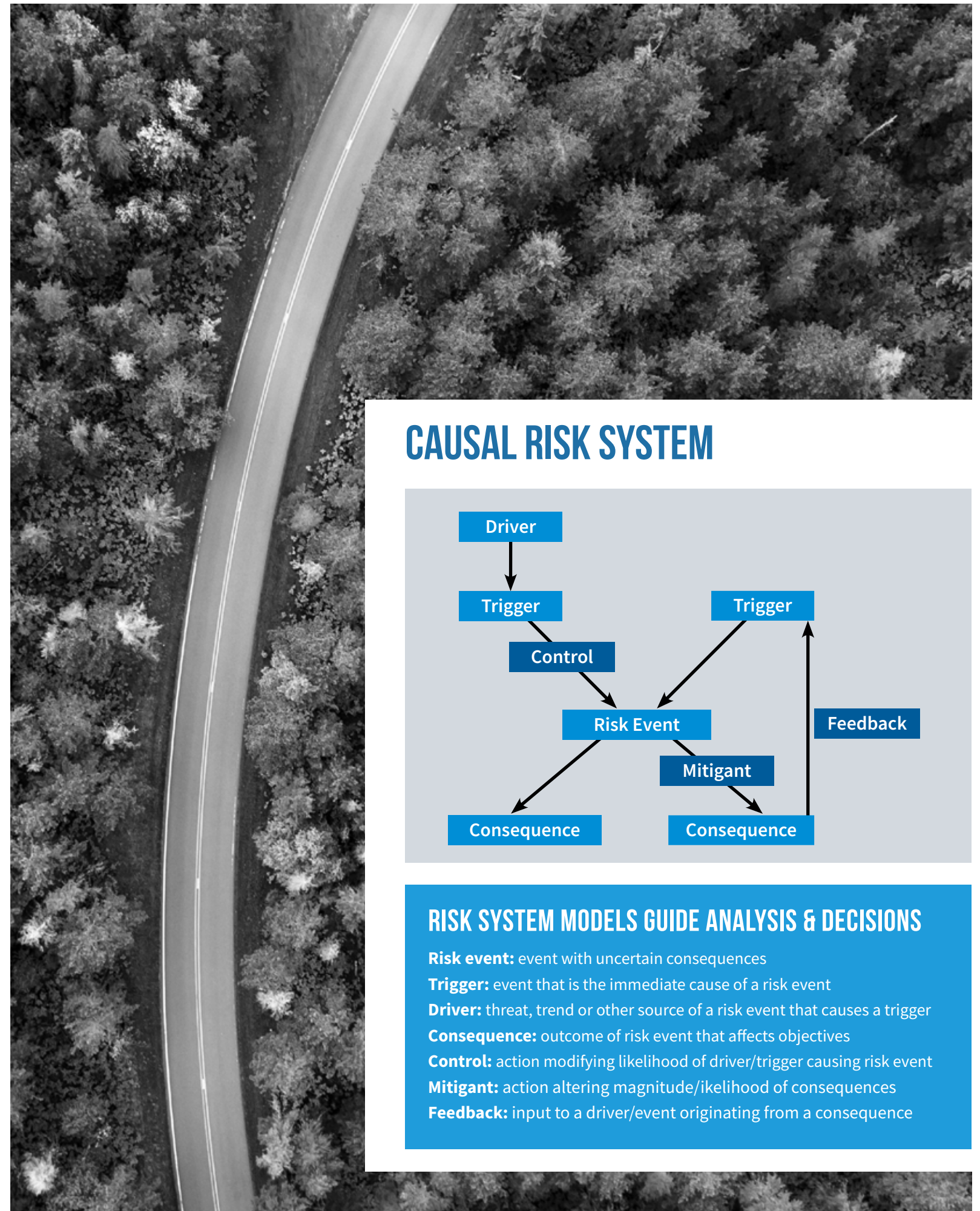
Trained facilitators design & conduct participatory processes integrating different forms of knowledge

Expert analysis draws on both quantitative and qualitative data

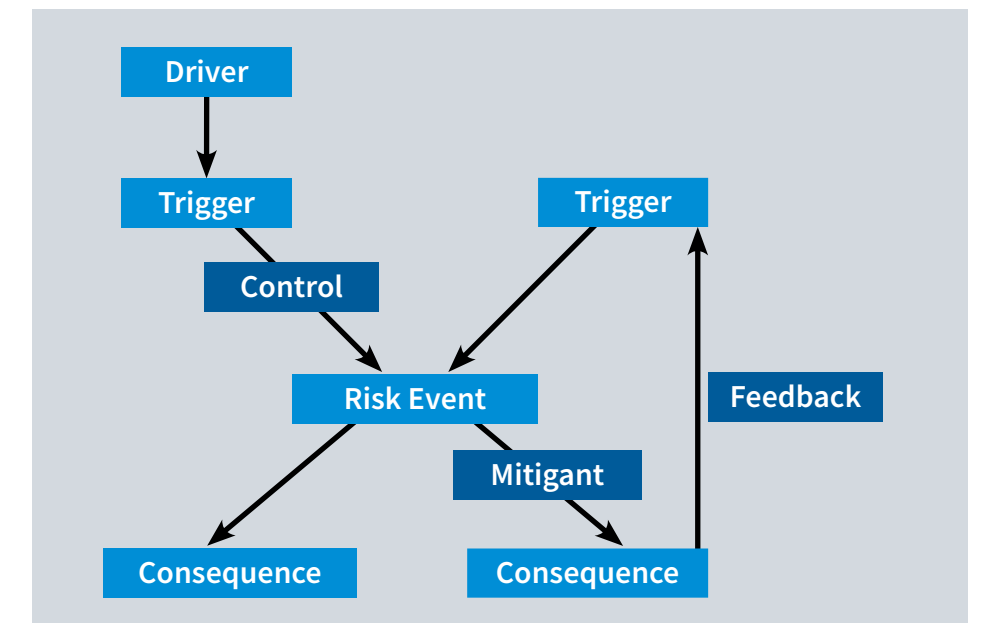
The Guide to the ROAD Process is updated to reflect lessons from applying ROAD in the field

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EACH APPLICATION ADAPTS THE ROAD PROCESS TO THE SPECIFIC GOVERNANCE CONTEXT AND RISKS



CAUSAL RISK SYSTEM



RISK SYSTEM MODELS GUIDE ANALYSIS & DECISIONS

Risk event: event with uncertain consequences

Trigger: event that is the immediate cause of a risk event

Driver: threat, trend or other source of a risk event that causes a trigger

Consequence: outcome of risk event that affects objectives

Control: action modifying likelihood of driver/trigger causing risk event

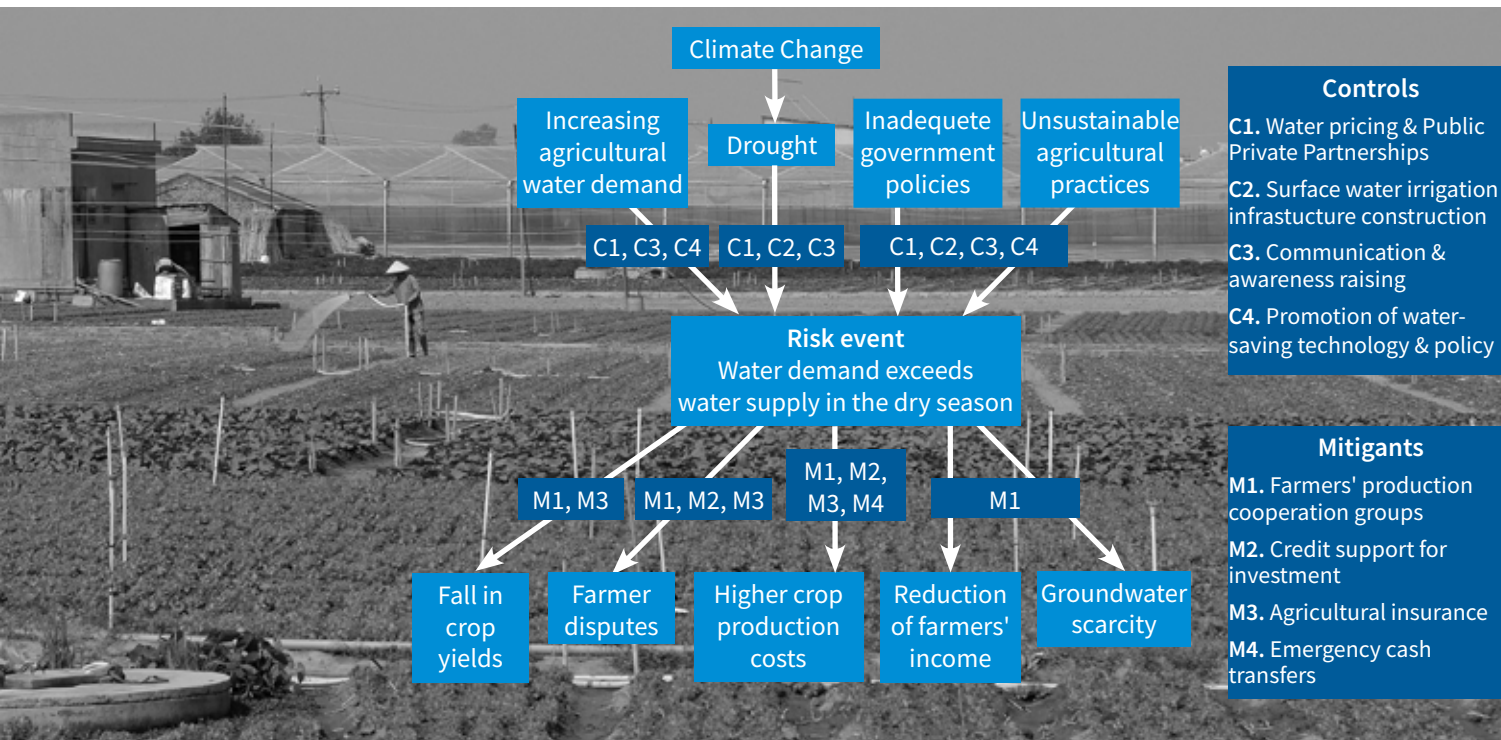
Mitigant: action altering magnitude/likelihood of consequences

Feedback: input to a driver/event originating from a consequence

ROAD PILOT PROJECT

VIETNAM

In the Don Duong District of Lam Dong Province, provincial and national government agencies are trialling national water policy reforms. Intensive, high-value agriculture in this area is under threat from droughts, agricultural water pollution, and groundwater degradation



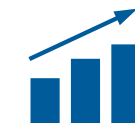
Scoping

- Survey of households and local officials
- Review of government reports and quantitative data
- Preliminary site visit and meetings with senior political leaders



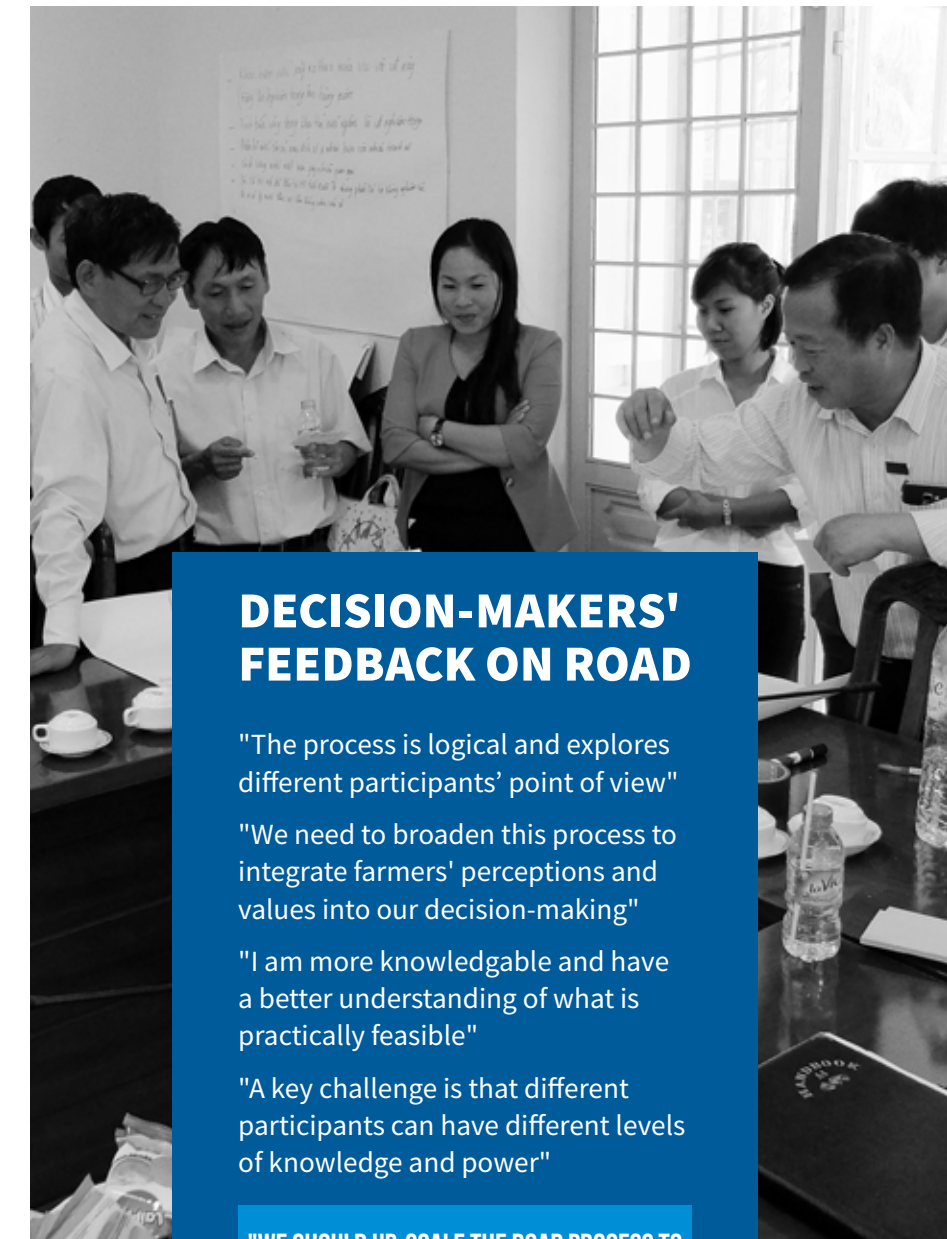
Workshop Facilitation

- Twenty district and provincial government officials participated in a 1-day workshop
- The risk event of dry season water scarcity was assessed and priority policy options were identified for further research by the project team



Analysis

- Project team analysed options and prepared guidance on implementation & secondary impacts based on experience in Vietnam and globally
- Results of analysis were reported to decision-makers and integrated into subsequent water reform pilots



DECISION-MAKERS' FEEDBACK ON ROAD

"The process is logical and explores different participants' point of view"

"We need to broaden this process to integrate farmers' perceptions and values into our decision-making"

"I am more knowledgeable and have a better understanding of what is practically feasible"

"A key challenge is that different participants can have different levels of knowledge and power"

"WE SHOULD UP-SCALE THE ROAD PROCESS TO OTHER DISTRICTS ACROSS THE PROVINCE"

12 MONTH PROJECT WORKING WITH PROVINCIAL, DISTRICT AND NATIONAL GOVERNMENT AGENCIES

Project Partners

IDH - The Sustainable Trade Initiative

Institute of Policy and Strategy for Agriculture and Rural Development, Vietnam

Australian National University

Water demand in Vietnam is growing rapidly in response to industrialisation & population growth. Water pollution & climate change are adding further pressure on water availability.

Government agencies are piloting new policies in Don Duong District that could help address regional & national water shortages.

Farmers in Don Duong grow vegetables, flowers & other commercial crops.

Farming in the district is very profitable, but unsustainable due to rapid groundwater depletion & excessive pesticide & fertiliser use.

Government officials collectively developed a causal model of the risk of dry season water scarcity in Don Duong. Options were assessed across a range of criteria. Participants selected priority options for further research by the project team.

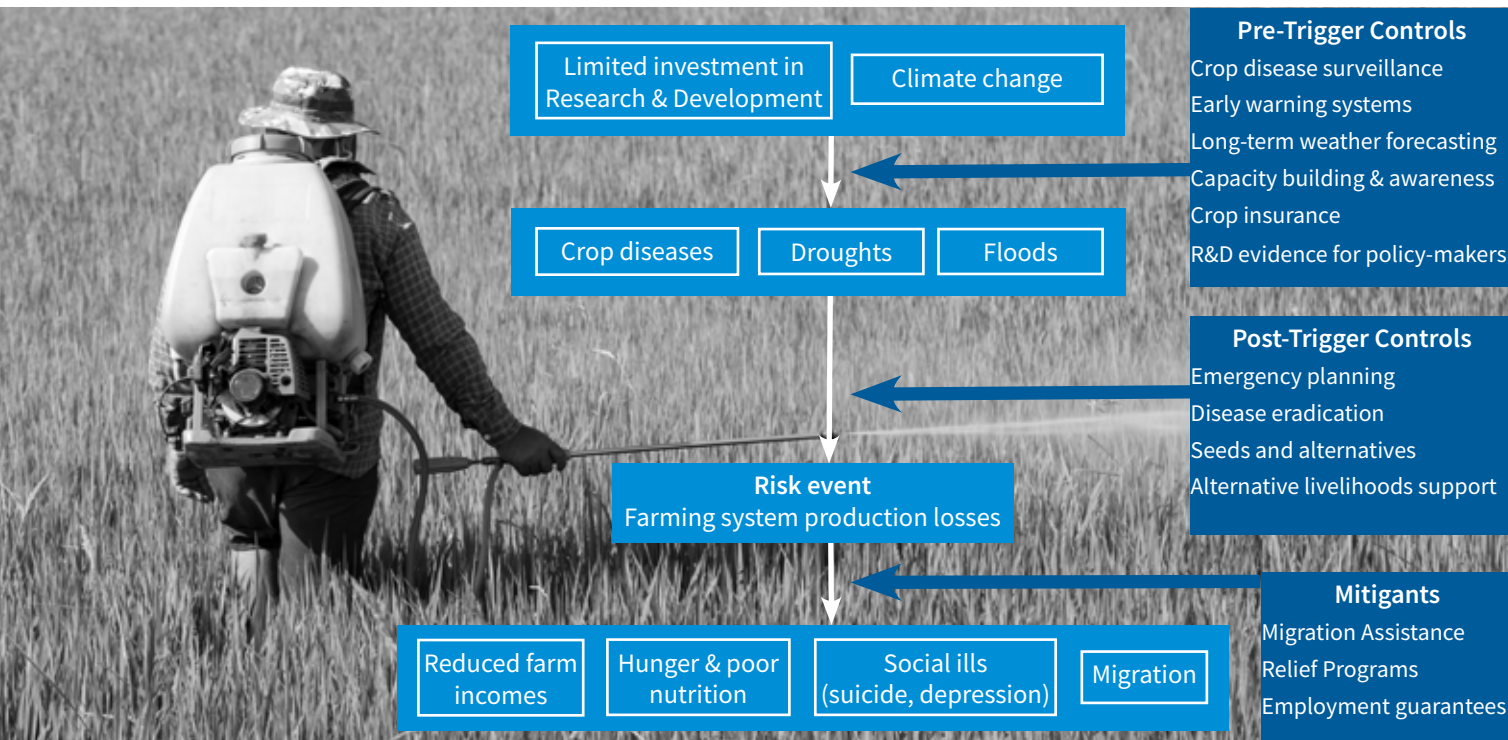
KEY FINDINGS FROM THE ROAD PILOT IN DON DUONG

- Farmer acceptance of water pricing reform requires compensation for higher input costs
- New irrigation infrastructure may exacerbate pollution & may not alleviate water shortages
- Investments are needed in social institutions for groundwater management
- ROAD can be used in contexts where participatory decision-making is seldom used
- Facilitators need to guide participants' towards the decisions & actions under their control
- Credibility of the process at the local level required a cascade of consent from higher levels

SUSTAINABLE AGRICULTURAL INTENSIFICATION

SOUTH ASIA

Agricultural intensification is a key strategy to reduce rural poverty in the Eastern Gangetic Plains (India, Bangladesh and Nepal). Improved rural livelihoods will not be sustained if more profitable farming systems undermine water security



Quantitative Modelling

The IMPACT model and GFWS platform generated trajectories for food and water demands under alternative policy scenarios



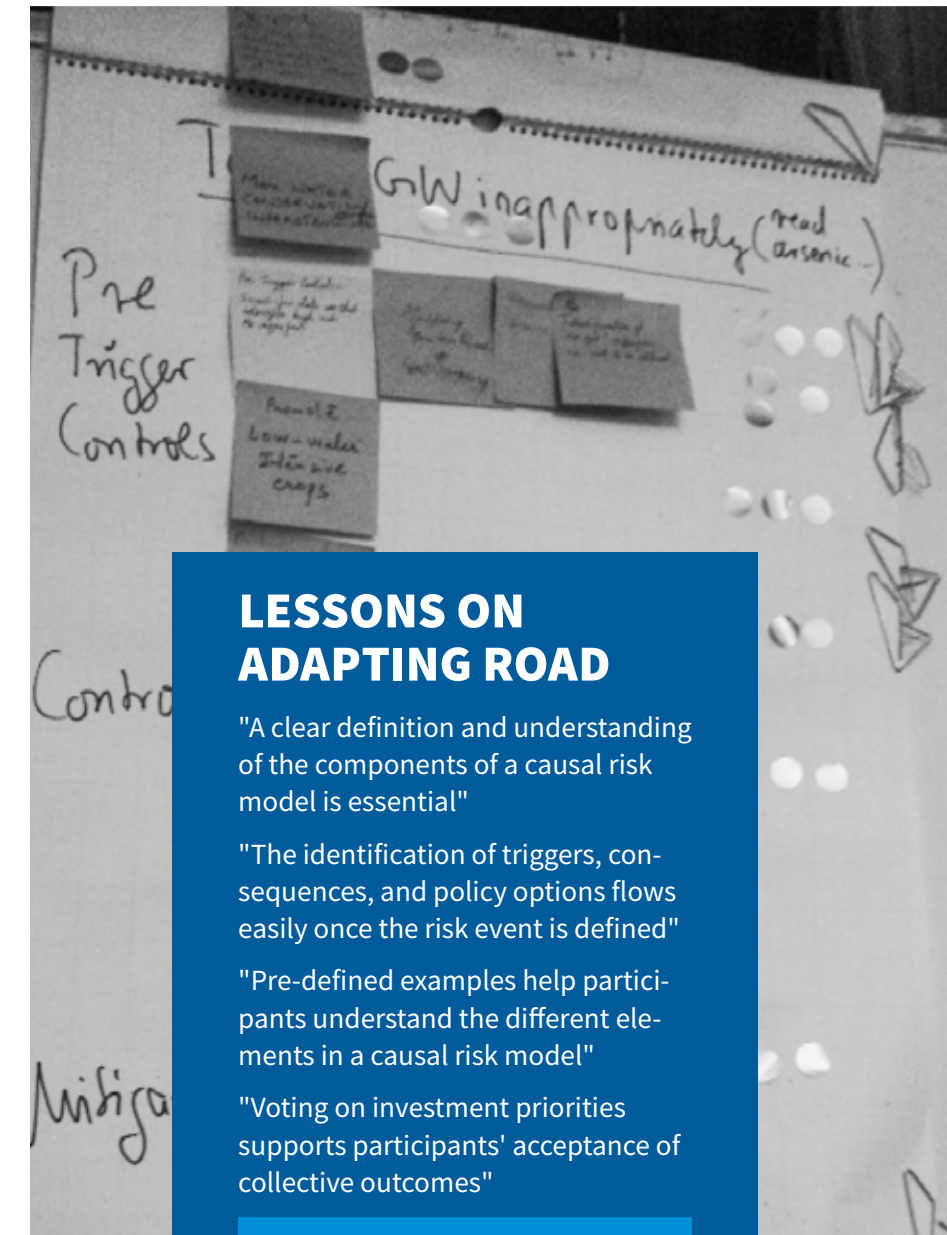
Workshop Facilitation

FE2W Network Members facilitated causal risk modelling by 5 break-out groups that reported back to all 60 participants



Engagement

Participants from multiple countries and organisations developed common perceptions of causal risk systems and identified research priorities across food-energy-environment-water systems



LESSONS ON ADAPTING ROAD

"A clear definition and understanding of the components of a causal risk model is essential"

"The identification of triggers, consequences, and policy options flows easily once the risk event is defined"

"Pre-defined examples help participants understand the different elements in a causal risk model"

"Voting on investment priorities supports participants' acceptance of collective outcomes"

PARTICIPANTS PRIORITISED PREVENTING RISKS OVER MANAGING CONSEQUENCES

8 MONTH PROJECT WITH GOVERNMENT OFFICIALS, LOCAL EXPERTS AND STAFF FROM DONOR AGENCIES

Project Partners

Australian Centre for International Agricultural Research

Australian National University

International Food Policy Research Institute (IFPRI)

SaciWATERS

This project supported the delivery of two major programs in the Eastern Gangetic Plains (EGP) by the Australian Government & a consortium of development partners.

Project outputs included assessment of the effects of water-food-energy policies on resilience & livelihoods in the EGP. Causal modelling of risks & policy options enabled identification & planning of appropriate interventions.

A key focus was the use of qualitative causal risk models to inform quantitative modelling of regional food-water-energy systems. This combined modelling enabled the generation of common insights across local-level projects.

Participants in foresight workshops and dialogues used the risks & options assessment to identify research gaps & the sequencing of policy interventions.

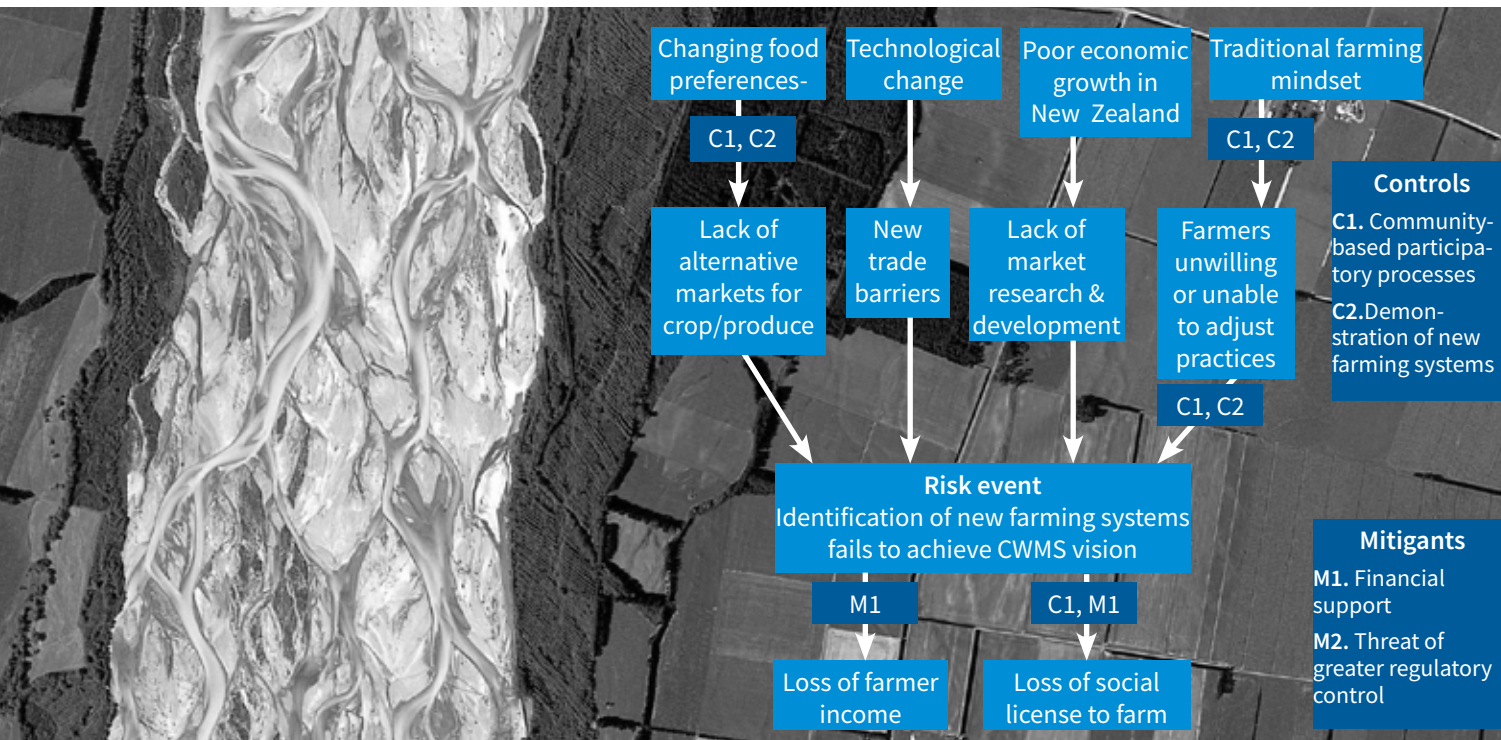
KEY FINDINGS FROM THE EGP FORESIGHT WORKSHOPS

- 1 Lack of access to technology is not the key barrier to greater output and farmer prosperity
- 2 Current policies and institutions do not facilitate the scaling up of successful innovations
- 3 There is a clear need for stronger agricultural extension services in all three countries
- 4 Causal risk models can effectively link stakeholder assessments to quantitative modelling
- 5 Donor programs should examine the economic costs & benefits of solar pumps
- 6 Migration and the feminisation of agriculture are key issues for vulnerable households

POLICY IMPLEMENTATION RISKS

NEW ZEALAND

Agricultural water pollution in Canterbury is undermining environmental water quality and human health. The Canterbury Water Management Strategy is being implemented to enable sustainable exploitation of the province's water resources



Design

FE²W Network Members worked with local researchers to design and test a rapid causal risk modelling exercise

Workshop design reflected participants' experience, knowledge, and the interests of the different groups they represent



Workshop Facilitation

The ROAD process was presented to participants and local water management issues reviewed

Participants split into two groups to undertake a 2 hour causal risk modelling exercise to test whether ROAD could be used in Zone Committee decision-making and community consultation



Assessment of Policy Options

Participants identified negative and positive secondary impacts of planned policies across causal risk systems

Investment priorities were identified for actions to manage policy implementation risks



DECISION-MAKERS' FEEDBACK ON ROAD

"Causal modelling structures the discussion and pathways"

"Rapid fire means of getting to the main points"

"Could be tested by separate stakeholder groups and then a collective group to bring diversity of thought"

"Success of the workshop was supported by a knowledgeable group of participants"

"Requires skilled facilitation"

"WOULD BE INTERESTED TO SEE ZONE COMMITTEES USE ROAD IN DECISION-MAKING"

1 DAY WORKSHOP WITH FARMERS, BUSINESS LEADERS AND LOCAL GOVERNMENT OFFICIALS

Project Partners

Environment
Canterbury

Lincoln University

Australian National
University

The Canterbury Water Management Strategy (CWMS) was developed by local government with indigenous groups, water users & communities.

The CWMS vision is:

"To enable present & future generations to gain the greatest social, economic, recreational & cultural benefits from our water resources, within an environmentally sustainable development framework"

Multi-stakeholder Zone & Regional Committees are implementing rules & approaches regionally & locally.

This project evaluated how ROAD could support implementation & mitigate the risk that the following measures fail to achieve the CWMS vision:

- managed water capture
- identification of new farm systems
- urban volumetric water pricing
- CWMS planning framework

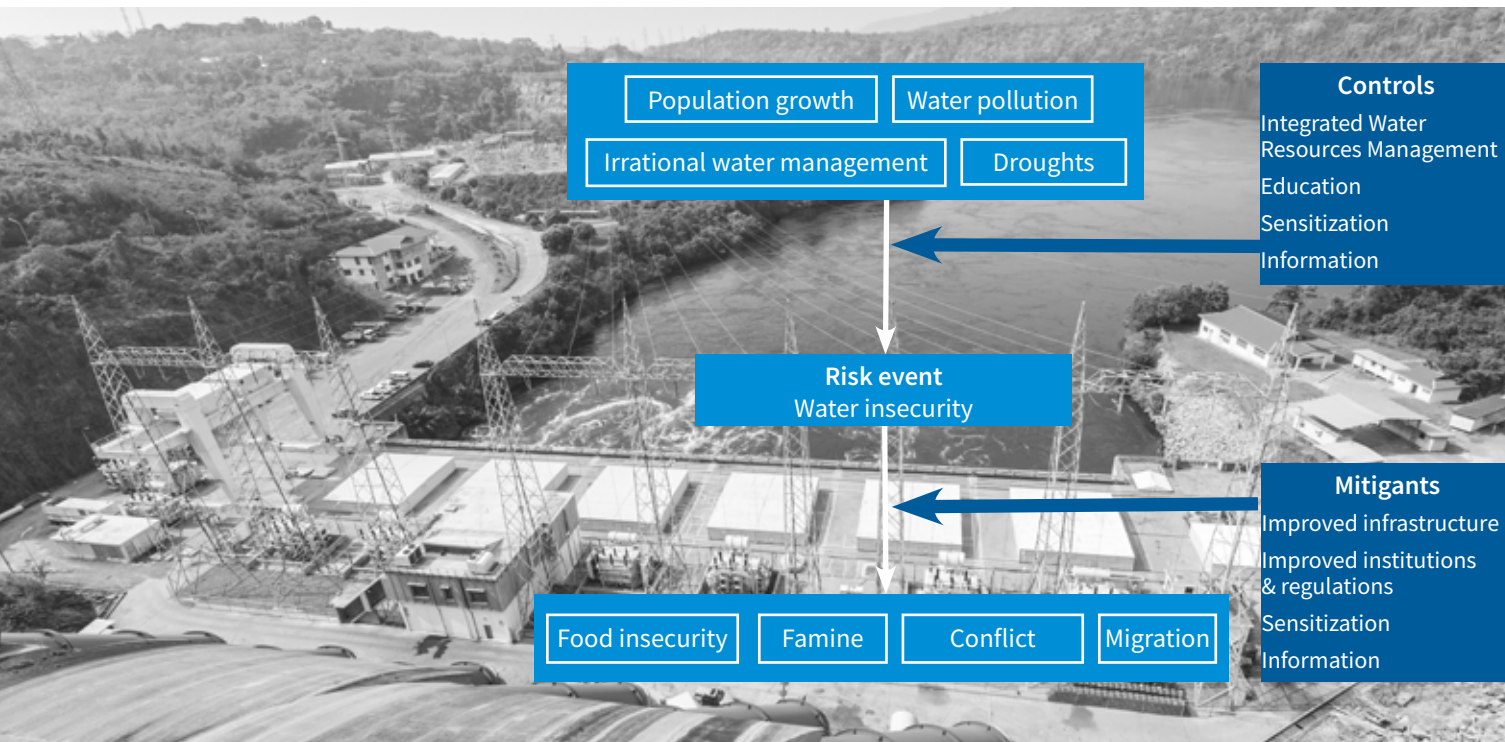
KEY FINDINGS FROM THE CANTERBURY WORKSHOP

- 1 Community-led participatory decision-making is a key tool for policy implementation
- 2 ROAD could be a useful tool for CWMS implementation and post-2020 regional planning
- 3 Effective participation in a local-level ROAD process would require multiple engagements
- 4 Facilitators need to be well-trained to design & deliver causal risk modelling workshops
- 5 Trade-offs between reductionism & completeness need to be managed in risk modelling
- 6 Non-government organisations need to play a central role in policy implementation

TRANSBOUNDARY WATER COOPERATION

NIGER RIVER

The Niger River Basin in arid West and Central Africa is home to over 130 million people. The Niger Basin Authority has developed over 300 projects in its 2016-2024 Operational Plan to achieve the Niger Basin Shared Vision of water-food-energy security and environmental sustainability



Scoping

- Document reviews
- Key informant interviews
- Group workshops with officials from 9 basin countries
- Hydrological modelling



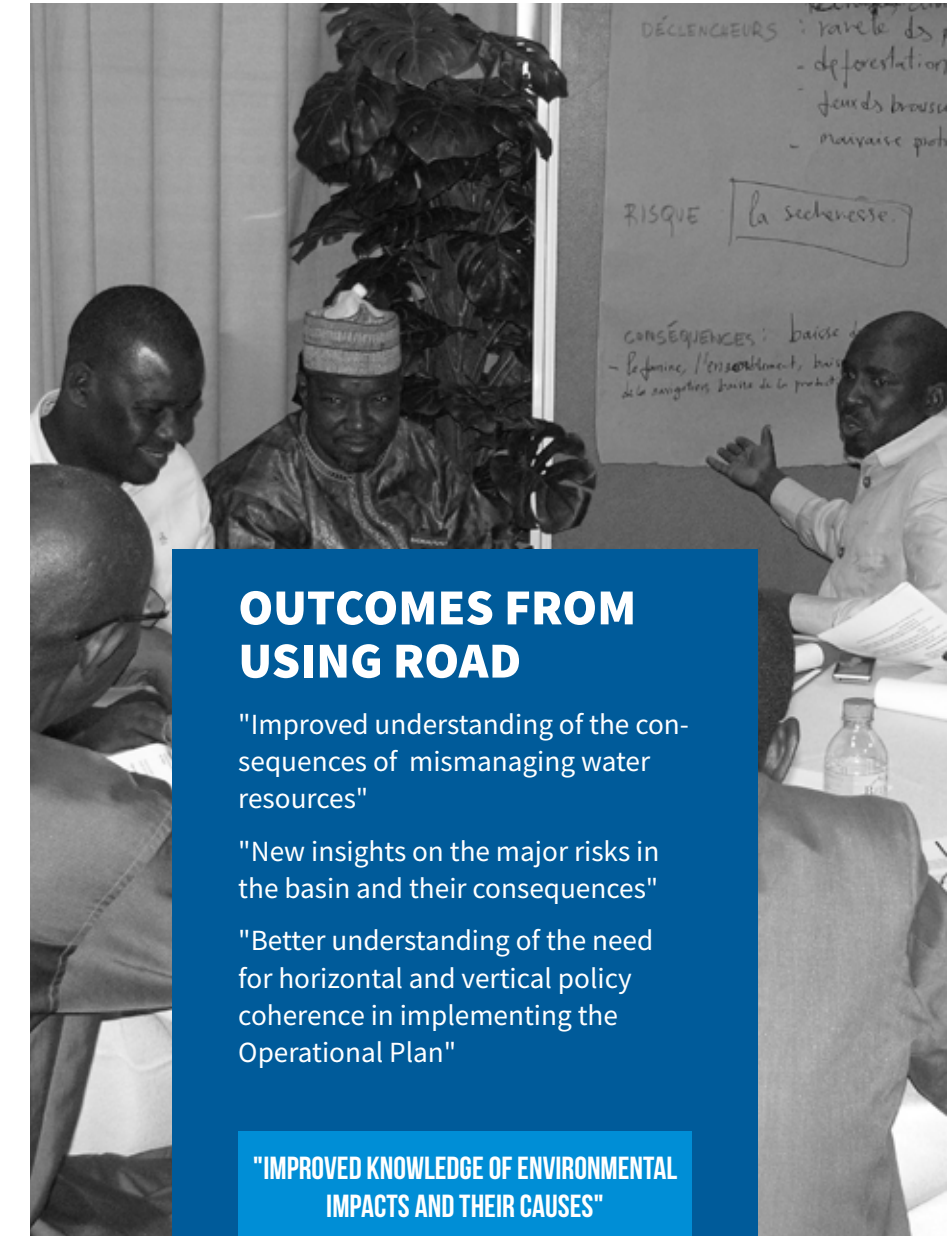
Workshop Facilitation

- Participants from different ministries and other agencies in the basin divided into country groups to assess specific projects & risks
- The common causal modelling framework supported participants understanding of issues across different countries



Integrated Assessment

- The ROAD process identified measures to address key risks across the Niger Basin
- Risk assessment results guided identification and ranking of the linkages of NBA Operational Plan projects with water-food-energy security & environmental sustainability in a transboundary context



OUTCOMES FROM USING ROAD

- "Improved understanding of the consequences of mismanaging water resources"
- "New insights on the major risks in the basin and their consequences"
- "Better understanding of the need for horizontal and vertical policy coherence in implementing the Operational Plan"

"IMPROVED KNOWLEDGE OF ENVIRONMENTAL IMPACTS AND THEIR CAUSES"

8 MONTH PROJECT TO SUPPORT THE NEXUS REGIONAL DIALOGUE ACROSS 9 COUNTRIES

Project Partners

GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit

European Union

International Food Policy Research Institute

Niger Basin Authority

The Niger Basin Authority (NBA) has identified a wide range of investments, ranging from large dam construction, irrigation infrastructure & equipment, & ecosystem preservation, to strengthening of institutional capacity.

The African Development Bank, the World Bank & others have pledged substantial resources towards the sustainable development of the Niger Basin's water resources

Without careful assessment of these projects and their interlinkages, food & energy insecurity could rise and fragile water, land, and ecosystem resources could be irreversibly damaged.

This project used ROAD & the ICSU Framework for Sustainable Development Goal (SDG) Interlinkages to assess the potential cross-sectoral impacts of planned projects & identify 'win-win' investments that achieve multiple objectives.

KEY FINDINGS FROM THE NIGER BASIN WORKSHOP

- Participants identified drought, water shortage, insecurity & sedimentation as the key risks to achieving the Niger Shared Vision
- Controls to avoid the occurrence of risk events were prioritised over mitigants that reduce the adverse outcomes from risk events
- The majority of Operational Plan projects achieve multiple objectives (i.e. water security, energy security, food security, environmental sustainability) but this is not always explicit
- Cross-sectoral implementation & monitoring can improve outcomes across many objectives

KEY LESSONS

The ROAD process has been updated following pilot projects in a variety of geographic & decision-making contexts



Guide to the ROAD Process Version 1.0

The Guide provides a step-by-step overview of the ROAD process that can be adapted to a range of contexts by facilitators & project partners

The Guide is periodically updated to integrate lessons from FE²W Network projects

STAKEHOLDER ENGAGEMENT

- 1 Cultural barriers & hierarchies may prevent some stakeholders from sharing a participatory setting
- 2 Replicating causal modelling at different decision-making levels supports knowledge transfer
- 3 Participants' perception of process credibility is supported by consent of senior levels of authority

RISK ASSESSMENT OF OPTIONS

- 1 Identifying the unintended outcomes of potential decisions is a key value-add of ROAD
- 2 Both technical & stakeholder knowledge are needed to estimate outcomes from decision options
- 3 Secondary assessments should be conducted with stakeholders impacted by potential decisions

IMPLEMENTATION

- 1 Trained facilitators are needed to design and deliver participatory workshops
- 2 ROAD can be adapted to long-term (12+ months) & very short-term (1/2 day) applications
- 3 Process design must adapt to local perceptions of risk & be guided by a local partner organisation
- 4 ROAD is highly flexible: the process can be applied in a range of cultural & decision-making contexts

NEXT STEPS

STEP 1

- Apply ROAD across the decision-making process
- Work with a range of partners & decision-makers
- Learn & innovate

Apply the ROAD Process in a range of contexts

The FE²W Network is ready to work with partners to use ROAD to develop & monitor decisions on complex risks

We will continue to learn & innovate as we adapt ROAD to a range of risks in both data-rich and data-poor locations

We will work with communities, businesses & government to connect their respective decisions and values

STEP 2

- Share knowledge & expertise
- Develop local & internal capacity
- Build local hubs for better decision-making

Train facilitators in local partner organizations

ROAD will only generate sustainable social benefits if local partner organisations have the capacity to independently adapt and develop the process within their context

Partner organizations will become hubs for building the capacity of local decision-making organizations to internally undertake participatory, systems-based risk assessments

STEP 3

- Develop new modelling tools
- Adapt methods, tools & analysis from advances in science & practice

Develop & adapt tools to address complex risks

The ROAD process is one of many tools to enable better decision-making on complex risks

The FE²W Network will develop and apply new quantitative and qualitative tools. We will adapt participatory methods, diagnostic tools & decision analysis from advances across disciplines of research & practice

BELLAGIO

In 2016, FE²W Network members met at the Rockefeller Foundation facilities in Bellagio, Italy. The participants worked together on developing the ROAD process and designing the ROAD pilot projects in Vietnam and South Asia



3-DAY WORKSHOP TO TEST, CONTEST & REVISE A PROTOTYPE ROAD PROCESS

22 PARTICIPANTS | 11 COUNTRIES | RESEARCHERS | PRACTITIONERS

The FE²W Network evolved from the ideas & collaborations developed at a workshop at Oxford University in 2014. The framework of the ROAD process was developed at this meeting around three key concepts: 'sustainable intensification', 'the food-energy-environment-water nexus' & 'resilience thinking'.

Participants in the 2016 Bellagio workshop converted this framework into the design of a practical tool for use by decision-makers at all levels. Experts from Vietnam & South Asia provided guidance on how to integrate cultural & institutional factors into the design & implementation of pilot ROAD projects.

Participants committed to:

- Delivering the ROAD pilot projects
- Developing the first version of a guide to the ROAD process
- Editing a special issue of an open-access, interdisciplinary journal on risk analysis for food-energy-environment-water systems
- Developing an accessible, online model on the FE²W website for users to explore linkages between water-food systems in large agricultural producing countries to 2050

EARTH'S FUTURE

In 2018, the FE²W Network edited a special collection applying risk and decision analysis to complex challenges across food-energy-environment-water systems. Leading scholars and practitioners contributed applied research findings from a wide range of disciplines



'RESILIENT DECISION-MAKING FOR A RISKIER WORLD' | OPEN ACCESS

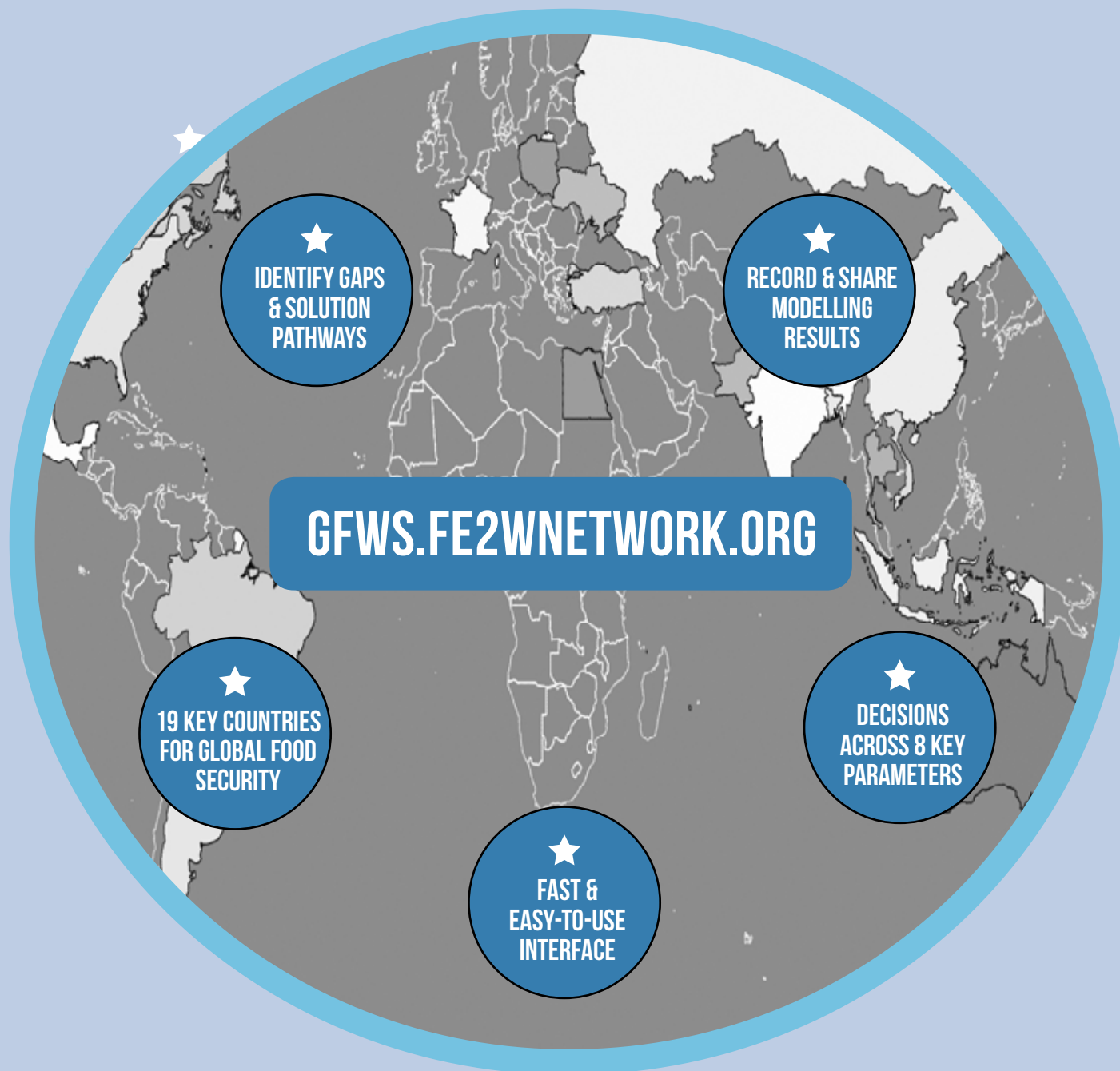
Available at: [https://agupubs.onlinelibrary.wiley.com/doi/toc/10.1002/\(ISSN\)2328-4277.RESDEC1](https://agupubs.onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)2328-4277.RESDEC1)

- | | |
|---|--|
| 1 | Methods for measuring the resistance and robustness of systems to change |
| 2 | Participatory approaches to integrating scientific modelling & stakeholder knowledge |
| 3 | Quantitative and qualitative frameworks for decision-making under risks & uncertainty |
| 4 | Case studies from Vietnam, Australia, Uganda, United Kingdom, Mexico & United States |
| 5 | Regional planning tools to identify & manage trade-offs under climate variability & change |
| 6 | Tools to integrate ecology and equity into planning decisions |

Enabling public access to scientific models of global food and water systems

GFWS PLATFORM

The Global Food and Water System (GFWS) Platform enables users to explore gaps between the supply and demand of food and water to 2050. The accessible, online interface promotes understanding of the relationships connecting food and water security and allows the identification of solution pathways



CONTACTS

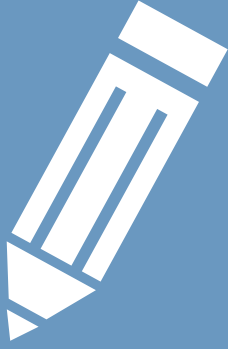


CONTACT US TO FIND OUT HOW WE CAN HELP YOUR ORGANISATION MANAGE RISKS

The 40 members of the FE²W Network have a range of expertise & experience working across different countries & regions. FE²W Network projects are coordinated at the host institution(s) of the member(s) leading projects

Please contact the members listed below to explore collaboration opportunities. Please contact **Quentin Grafton** (quentin.grafton@anu.edu.au) with any general enquiries or to be connected with other expertise within the FE²W Network

CONTACT	EXPERTISE	COUNTRIES/REGIONS
CLAUDIA RINGLER International Food Policy Research Institute c.ringler@cgiar.org	<ul style="list-style-type: none"> ■ Agricultural policy ■ Agent-based modelling ■ Climate change adaptation ■ Food & water security 	<ul style="list-style-type: none"> ■ South Asia ■ Sub-Saharan Africa ■ Latin America ■ East & South-East Asia
QUENTIN GRAFTON Australian National University quentin.grafton@anu.edu.au	<ul style="list-style-type: none"> ■ Water markets & pricing ■ Resilient food systems ■ Energy economics ■ Management of marine reserves 	<ul style="list-style-type: none"> ■ Australia ■ Canada ■ New Zealand ■ Caribbean
DUSTIN GARRICK Oxford University dustin.garrick@smithschool.ox.ac.uk	<ul style="list-style-type: none"> ■ Transboundary water governance ■ Political economy of water reform ■ Environmental governance ■ Resilient cities 	<ul style="list-style-type: none"> ■ Sub-Saharan Africa ■ Americas ■ Murray-Darling Basin
PAUL WYRWOLL Australian National University paul.wyrwoll@anu.edu.au	<ul style="list-style-type: none"> ■ Hydropower economics ■ Participatory methods ■ Hydro-economic modelling ■ Systemic risk management 	<ul style="list-style-type: none"> ■ Mekong Basin ■ Vietnam ■ Australia
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SARAH WHEELER University of Adelaide sarah.wheeler@adelaide.edu.au	<ul style="list-style-type: none"> ■ Agricultural economics ■ Organic agriculture ■ Climate change adaptation ■ Water trading 	<ul style="list-style-type: none"> ■ Australia ■ Mozambique ■ Tanzania ■ Zimbabwe



FURTHER READING

Guide to the ROAD Process Version 1.0, available at: www.fe2wnetwork.org

'Decision-making for systemic water risks: Insights from a participatory risk assessment process in Vietnam' (2018), *Earth's Future*, available at: doi.org/10.1002/2017EF000777

'Possible pathways and tensions in the food and water nexus' (2017), *Earth's Future*, available at: doi.org/10.1002/2016EF000506

'Responding to global challenges in food, energy, environment and water: Risks and options assessment for decision-making' (2016), *Asia Pacific Policy Studies*, available at: doi.org/10.1002/app5.128