

PATTER, Volume 2

Supplemental Information

The Role of Digital Technologies in Responding to the Grand Challenges of the Natural Environment: The Windermere Accord

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Appendix A: What comes next?

Inspired by the Windermere Accord Summit, October 2018

Harriet Fraser

Estimated anthropogenic global warming is currently increasing at 0.2°C (likely between 0.1°C and 0.3°C) per decade due to past and ongoing emissions (high confidence).

Where do you want to walk?
Shall we stroll together through the Valley of Despair,
kick our feet through leaves of fear,
brush against obstacles in industry, academia, politics?
Shall we wander in this fog endlessly?
Shall we retreat?

Avoiding overshoot and reliance on future largescale deployment of carbon dioxide removal (CDR) can only be achieved if global CO2 emissions start to decline well before 2030 (high confidence).

Or shall we stride up to the heights
to feel the light and take a wider view?
Shall we be ambitious, and push modesty away,
negotiate obstacles, face uncertainty,
keep our feet on the ground, earthed,
and as a community propose a new road map?

With 1.5°C of global warming, one sea ice-free Arctic summer is projected per century. This likelihood is increased to at least one per decade with 2°C global warming.

We have seen coral reefs dying
We have imagined their passing
We have modelled their death

We have imagined summer fields without butterflies
We have watched decline
We have modelled depletion
We have imagined a world without wild

The risk of irreversible loss of many marine and coastal ecosystems increases with global warming, especially at 2°C or more (high confidence).

What else might we imagine
from the sunlit heights?
Can we imagine a rapid end
to the toxic emission of carbon dioxide,
to the warming?
Can we imagine forests, growing

or the ocean, clean?
Can we make that happen?

Education, information, and community approaches, including those that are informed by Indigenous knowledge and local knowledge, can accelerate the wide scale behaviour changes consistent with adapting to and limiting global warming to 1.5°C.

There's pressure
to look for what you expect to see
where you expect to see it
but that's not where the interesting stuff lies

There are always questions
Where do we predict that we are going?
What do we need to know?
If we use models as tools to think with
are we choosing the right models?

Limiting global warming to 1.5°C, compared with 2°C, could reduce the number of people both exposed to climate-related risks and susceptible to poverty by up to several hundred million by 2050 (medium confidence).

Who's in the community?
What's in our tool box?
Sensors, computers, hope,
Knowledge, stories, reason
Empathy, connection, drive

We are part of the system:
systems within systems,
creating, adapting, imagining, learning
in the human-digital age,
integrated, inter-connected,
as natural systems are,

and we know: *Collective efforts at all levels,
in ways that reflect different circumstances and capabilities,
in the pursuit of limiting global warming to 1.5°C,
taking into account equity as well as effectiveness,
can facilitate strengthening the global response to climate change,
achieving sustainable development
and eradicating poverty
(high confidence).*

Quotes taken from the IPCC (Intergovernmental Panel on Climate Change) report summary for Policy Makers, October 2018

Appendix B: Annotations around the elements of the Accord

1. USING DIGITAL TECHNOLOGY TO TAME UNCERTAINTY IN A CROSS-DISCIPLINARY WAY.

Use what we already know about uncertainty in env. science. DT/Env Ch. communities learn from each other's approaches.

Including understanding the role of uncertainty in decision making - also starting with this understanding when defining research

Bringing together experts in uncertainty & environmental science

It's a long game - slow for uncertain values →

Focus on implementation on policy relevant

WHICH UNCERTAINTY REALLY MATTERS

VOICE STUFF WE KNOW MORE THAN UP CERTAINTY

QA of Data and Models

No longer being scared of uncertainty

STATISTICAL THINKING ↔ PERSONAL UNDERSTANDING

SELF-ADAPTIVE MODELLING & SYSTEMS FOR TAMING UNCERTAINTY

DEFINING THE STRUCTURE OF WHAT WE KNOW FOR SURE, ITS OUTLINES AND BORDERS

USING SEMANTICS TO UNDERSTAND THE MEANING OF DATA AND UNCERTAINTY, IN PARTICULAR.

technology to detect unexpected events & react to minimise undesirable effects

Critical thinking about existing results. Improve what we "used to do".

polygons NOT LINEAR

LOOK AT THE STABLES AND MOVE AWAY FROM POINT UNCERTAINTIES

Feedback for business of uncertainty to improve models and understanding of data

translate uncertainty to local decision

- Communicating it, policymakers don't like uncertainty
- Technology can also add uncertainty.
- Think about certainties.
- Accept ambiguity.

UQ

Extract meaning from uncertainty in decision contexts

don't lock to fully close uncertainty G-P just improve it.

SPECIFIC CHALLENGES & COMMON LANGUAGE

Need to 'anchor' these abstract notions in concrete environmental context. Can one have an equivalent of "1000 genome project" for example? How about "The Windermere project" capturing environmental change data over 50-100 yrs?

Capture uncertainty which is coming from digital technology itself.



Communicating uncertainty not just in stats but in visual ways, "show & tell" evidence

a virtual catchment -> where everything complex parts and all are integrated (feedback + complexity) must be modelled & explored

Can we embrace uncertainty instead of taming? Then understand where we need more knowledge/process/complexity in order to affect/influence decisions? Complex into concrete? help messaging

2. ADVOCATES + CHAMPIONS TO ENABLE, EMPOWER AND INFLUENCE.

Training

Need for training next generation leaders in effective comm & methods

Use every opportunity to spread the word responsibly

How do we build trust across gaps

EMPATHY LISTENING! give a voice to those who do not (feel they) have one

THINK OF WHAT IS AT STAKE

Effective two-way kb and translation

- Training at all levels
 - studentships
 - senior academics (cross-disciplinary)
 - language tech term translation
 - business/policy maker-facing
 - people (general public)
 - children

CAN'T RELY ON SMALL NUMBER OF INDIVIDUALS

CRITICAL THINKING AND AUTONOMY

BIG DATA ANALYSIS TO CREATE MORE INFLUENCING OPPORTUNITIES

EVERYONE OF US IS A CHAMPION & INFLUENCER

LET EXPERIENCE SPEAK

We can all be champions, we can all have give, we don't need to look for specific grants to stand on the shoulders of.

ENGAGE WITH PUBLISHED AGENCY TO ANTICIPATE EVIDENCE NEEDS E.G.: - DEBRA 25 YEAR ENV PLAN - WALES ENVIRONMENT ACT - MEMBERS OF FUTURE GENERATIONS

MAKE "AI FOR ENVIRONMENT" THE NEXT ALPHAGO MOMENT

GLINE MAKES/EMPOWER AND ACCOUNTABLE market leaders show the way to go as champions

CREATE FORA WHERE ADVOCATES CAN ENGAGE KNOWLEDGE NEEDS TO DIRECT RESEARCH AND CHAMPIONS CAN SHARE RESEARCH TO INFORM POLICY MAKING

USE ADVOCATES AS INFLUENCING DEVICES USE COMPARISONS TO DEMONSTRATE THE NATURAL COMMON TO (A TRIP OUTSIDE NEWS)

Structure to assist this.

help identify responsibility

Identify & train the glue people who are those glue people?

4. INTEGRATION AND FEEDBACK

(WE KNOW WHAT WE MEAN)
Integrative solution oriented tools & methods

multi-scale
self-adaptive
integration

A good example helps...
Can we try to do it for
somewhere.

Collaborative working
practice to bring
approaches together

Knowledge map - gap analysis - big env. Qs

- what can be done already?
- what needs improving?
- which methods (data sci / physical process) are better when?

Tolerance and understanding
of different perspectives.

Brand as "AI for Environmental Science"
for political relevance

Semantics
+ uncertainty in the
semantic modeling

FOCUS ON
WHAT MAKES
A DIFFERENCE
AND MAKE
COMPLEX PROBLEMS
TREATABLE
(80/20 IT!)

Technology for
Adaptive Integration

DYNAMIC
ADAPTIVE
MODELS &
SYSTEMS

we shouldn't
ponder too
long terms
'of the day'

PROVIDE AN
INTEGRATED VIEW
(NOT THE SAME AS
HOMOGENEOUS)

we should hold
ourselves in higher
esteem?

linking platforms
to enable cross-disciplinary
and whole of data life cycle
approach.

Being able to
understand how
you fit into
the bigger
picture

avoiding trade-offs
not being created for
and sub-optimal decisions
leading to loss of studies

Facilitating
the communication
between different
scientific disciplines

Environmental
Equilibrium
is totality.

Social narratives
+ social sciences
to add richness
+ stories to
data & tech

20% PROBABLY!
NEED TO BE
AGILE + ADAPTIVE
Just do it?
and don't
worry about
it failing?

MULTIMODAL DATA

INTEGRATED PLURALITY OF VIEWPOINTS

"NOT JUST
PASSIVE USER" - no "skinny answers"

ENABLE SYSTEMS TO SELF
LEARN TO IMPROVE
USER EXPERIENCE

Developing a common
language to facilitate
the integration

Using digitalization
of the environment
& data science techniques
to better understand climate
feedback mechanisms

never stop
learning and
allowing for change.

NEW WAYS OF
TACKLING COMPLEX
PROBLEMS WITH
DISTRIBUTED TEAMS
AND SHARING KNOWLEDGE
RAPIDLY ACROSS
TEAMS GLOBALLY

Self Adaptive models
with a feedback loop
Some supporting
frameworks

IMPACTS OF MULTIPLE
DRIVERS ON MULTIPLE
ENDPOINTS

Need to plan feedbacks
in project lifecycle otherwise
information may be lost
after 2/5 years when projects
finish.

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5. BUILDING A DIGITAL ENVIRONMENT COMMUNITY FOR 'TODAY AND TOMORROW' FOR THE FUTURE

Diverse voices and perspectives

COORDINATION OF DIFFERENT ENVIRONMENTAL DATA SCIENCE TO MAXIMISE VALUE TO UK + WORLD

E.G. ENSEMBLE, DEFRA DIGITAL TRANSMISSION, DAFNI, JASMIN

not just focusing on rural! issues such as plastics in water - it is short-lived and makes other issues

LONG-TERM COMMUNICATION AND COLLABORATION

Inspire "wider" Digital Community to take initiatives + be part of this effort.

promoting cross-disciplinary seminars to bring people together

Find way of talking + maintaining community + growing community

What can we learn from other facing similar cross-disciplinary community issues (esp. when we are not co-located physically)

How do you incentivise? give a home to digital champions of tomorrow's jobs

Enable more opportunities to internet

Make it fun + funking

INTRINSIC MOTIVATION WE NEED FASCINATING PROBLEMS!

Hold annual "All Hands Conference" (worked for eScience...)

Using the dig. tech. to open science to transparency to the wider community

nature early career researcher

Attract great people (esp. Comp Sc.) to this community.

MAKE NOISE

Resource - need people to do grass-roots research.

announce our intentions to the wider community

Commitment + motivation appropriate space.

at the theme of community integration of digital technology in undergraduate curriculum

"KNOWLEDGE FABRIC"

DT / Env Change interface.

Attract more people through doing

increase social scientists' commitment work

TAKE THAT COMMUNITY OUT OF DIGITAL ADDRESS THE PRACTICAL QUESTIONS EARLY IN ASIA

Long-term, sustainable, virtual & physical community

Worked examples for Twitter, Facebook, Science Citation Index, and of Science and Citizenry

- Institute
- Conference
- Journal

DECISION-MAKING (THE ARCH)

NOT THINKING ABOUT SOMETHING IS STILL A DECISION

COMMUNICATE 'KILLER FACTS' TO SET POLICY MAKES DIRECTION OF TRAVEL

Both the process and the decision recognising that decisions require a partnership to implement & evaluate

HOW DOES IT REALLY HAPPEN? NEED TO UNDERSTAND TO INFLUENCE

Who makes the decisions?

minimize the gap between knowledge (about the environment) and decisions (impacting the environment)

Making people aware that we can/make decisions

Make informed decisions easy

Clear agendas

POWER = ACCOUNTABILITY

→ CAN LIE WITH THE MANY NOT PRINCIPLED DECISIONS JUST THE FEW WHERE UNCERTAINTY ABUNDANTS

Incorporate community feedback in decision-making

FRAMING QUESTIONS SINCE DECISIONS FROM ANSWERS THE COULD

Talking to people involved in making decisions and finding out what they do and how they approach e.g. placements with natural hazard incident responses, govt (local, national), business

INTEGRATE CROSS-DISCIPLINARY EFFORTS FOR BETTER INFORMED DECISIONS

Communicate impacts of decisions requires - mind subject level + longer of uncertainty

Train scientists in skills for influencing 'up' and in financing 'down' DECISION MAKING AT DIFFERENT SCALES

Understand the un-understandable! Why decisions are made? Where does evidence go?

DECISION-SUPPORT WON'T ENOUGH - WE NEED TO CHANGE BEHAVIORES

Salient, robust and transparent decisions with societal buy-in

Making (everyone) decision makes

↳ and allow them to inform process

MIND THE GAP