Output from Break out discussion 1(transcribed from provided post-it material):

Recent and on-going climate resilience research in NI

Recent/on-going research	Research organisation	Key contact person
Environmental - AGRICULTURE/ C SEQUESTRATION		
Farm		
Optimising application of novel parasite control tools in livestock under climate changes to combat drug resistance. NI farms/QUB labs, UK, Africa	QUB	Eric Morgan
Climate driven models of parasite epidemiology on livestock farms and risk management.	QUB	Eric Morgan
Land management to reduce impact farming	QUB	Nigel Scollan
Low carbon farming and food	QUB	Nigel Scollan
Reducing emissions from ruminant agriculture	QUB	Nigel Scollan
Land/soil		
Ramped pyroxidations/combustion can characterise carbon sources in bulk material: freshwater C burial; soil carbon cycling; wetland c sources; peatland C cycles	QUB	Evelyn Keaveney
Carbon cycling & burial in Lough Erne	QUB	Evelyn Keaveney
Using radiocarbon to quantify and characterise carbon buried in a eutrophic lake (Rostherne Mere UK)	QUB	Evelyn Keaveney
Nutrient and runoff strategies using crop systems	AFBI	G Hoppe
Impact of climate change on nutrient fluxes in the environment. Focus on C and N & P.	QUB	John McGrath
Inorganic weathering, bogs and climate influences	QUB (School of Nat and Built Environment)	Ray Flynn
Ecosystem services and peatlands including carbon loss; Peatlands, ecology and hydrology; Land use, peatlands flood risk	QUB (School of Nat and Built Environment)	Ray Flynn
Impact of climate change on GHG emissions from the agri food sector e.g. slurry	QUB	John McGrath
Plant/forestry		
Plant community shifts over 100 years artic Sweden	QUB	Paul Caplet
Grassland production resilience and associated biodiversity	QUB	Mark Emmerson
Species range modelling with climate projects	QUB	Neil Reid
Variety evaluation on grass, clover and cereals	AFBI Crossnacreevy	Lisa Black
Use of clover crops in NI rotational systems	AFBI Crossnacreevy	Lisa Black
Grassland resilience Ireland	QUB	Paul Caplet, Mark Emmerson
Biostimulant mode and action abiotic stress project.	AFBI/QUB	Thomas Fleming/Fuquan Liu
Identifying opportunities for improving resilience of crops, forestry and environment by improving tolerance of plants to abiotc and biotic stress – resilience genotypes; modifying plant gene expression	AFBI	Colin Fleming

Identifying opportunities for new crops/varieties which may perform better in changing climatic conditions	AFBI	Colin Fleming, Lisa Black, Gerry Hoppe
Ash dieback/sawfly resilience project NI	AFBI	Thomas Fleming
Crop variety testing; Farm level production levels; Agroforestry systems; Soil health and impact on mitigation and C sequestration	AFBI	G Hoppe
Forestry adaptation – species origin sourcing	QUB	UCC, Caplat
Urban heat island X tree migration	QUB	Paul Caplet, Gregg O'Keefe
Marine/water		
Impact climate change on marine and coastal ecosystems	QUB	Nigel Scollan
Moses Project (EU Interreg) looking at marine economy including sustainability of Belfast port.	QUB	Christina Kelly
Coastal water supplies – salt water intrusion and climate risk	QUB (School of Nat and Built Environment)	Ray Flynn
Urbanisation, streams, ecology and extreme weather	QUB (School of Nat and Built Environment)	Ray Flynn
Modelling flood risk in uplands and impacts of extreme weather	QUB (School of Nat and Built Environment)	Ray Flynn
Flooding urban ark	QUB	Jenny McKinley
Economics, water treatment, conservation	QUB (School of Nat and Built Environment)	Ray Flynn
Modelling the fate of legacy contaminants – their introduction into the marine environment via adverse weather & coastal flooding event; their impact on marine life; introduction into the food chain via bioaccumulation in the food web; adverse effects on marine and human health – one health paradigm	QUB	Gary Hardiman
MARPAMM (Coastal processes) developing tools for monitoring and managing protected coastal marine environments in Ireland, Northern Ireland and Western Scotland. Focus Dundrum Bay	UU	Derek Jackson
SAFE WATER global technologies for clean water solutions (GCRF)	UU	Tony Byrne; Mike Brennan
Impact of large scale infrastructure projects (dams, wind farm) on indigenous communities in Mexico, Vietnam. Role of social and land rights	UU	Martin Ketola
Arch Bridges stability when subject to flooding	UU	B Solan
Treatment of wastewater for removal of antibiotics	UU	S Taeshioca McNally
Impact of flooding on sewer systems	UU	R Dermott
Storm impact on coastlines (North coast, SE Co Down)	UU	Derek Jackson
Interactions with marine biodiversity loss and fishing	UU/QML/TCD	Billy Hunter
Marine and coastal impacts (NW Europe/NI)	UU	Chris McGonigle, Andrew Cooper, Derek Jackson
Ground water monitoring in relation to salt incursion and habitat management	GSNI/BGS	Paul Wilson

Quaternary ice age and climate related geological processes	GSNI/BGS	Sam Roberson
Ice sheets and climate change (North Atlantic, Artic)	UU	Paul Dunlop, Sara Benotti
Looking at past climate change and its impact on societies (Ireland focused)	QUB	Gill Plunkett
Accept transitions – plastics system project	QUB	John Barry
Environmental and carbon dynamics over time	QUB	Maarten Blaauw
Climate change impact on ecological responses to other stressors	UU	Billy Hunter
Climate resilience research – interactions with emerging contaminants (Pharmaceutical pollution)		Billy Hunter
Climate change and antibiotic resistance	UU	Jeorg Arnscheidy
SPIRE 2; how consumer-owned energy storage can resolve the problem of the variability of renewable energy (RE) output.	UU	Neil Hewitt
Costal geo-technical research	iCRAG/UCD	
ARTIC adaptation and resilience tools for monitoring climate change impacts in NPA communities. Developing digital tools for local authorities and communities to monitor impacts of Climate change. NEED PARTNERS FOR FULL APPLICATION IN SEPTEMBER	UU	Paul Dunlop
Reuse of wind turbines – how green is green energy	QUB	Jenny McKinley
Developing renewable technologies for rural communities in Botswana	UU	Prof Mondol
SPIRE project heat storage system	UU	Prof Mondol
Decarbonisation of heat	UU	Inna Vorushylo
Geothermal energy potential in NI sedimentary - heat/cool storage	GSNI/BGS	Ros Raine
UKERC project 1. Decarbonisation of heat systems; Analyse perception and awareness among elderly women in NI for residential heating systems. **UKERC carries out world-class research into sustainable future energy systems**	UU Centre for sustainable technologies	Dr Iuna; Dr Catenave
TECHNOLOGY		
W-TECH hydrogen buses project	QUB	John Barry
Disaster communications; Flood monitoring systems; Machine learning approach to disaster telecommunications networks	QUB	Trung Duong
LOTNET Low temperature and heat recovery distribution (EPSRC)	UU	Neil Hewitt
Energy storage integration , oil to heat pumps in social housing (UK & Ireland)	UU	Patrick Keatley
IDEAS (H2020) Energy and building SMART renewable energy	UU	Ming Jun Huang
Remote sensing to monitor global environmental change using SWARM, CSES, satellites.	UU	Bi Yaxin
GIS energy efficiency (NI)	UU	Paul McKenzie, Sally Cooke
SOLA Catcher solar energy systems in Africa	UU	Megan Smith
PANI water (Photo-irradiation and Adsorption based Novel Innovations for Water-treatment) : PILAR (H2020 clean water solutions)	UU	Fernandez

POLICY – health/environmental		
Food related climate research, Health/public health research	QUB	John Barry
Working on the policy impacts on small dairy farmers. West of England	QUB	Lucy McCarthy, Anne Tombsenlic, Jane Glover
Hydrocarbon management, policies and consumption in context of climate breakdown. Public engagement and community education included	QUB	Amanda Slevin
Characterising and catalysing transition project (EPA funded) on identifying strategic issues for sustainability transformation.	QUB (School of Nat and Built Environment)	Geraint Ellis
SOCIAL SCIENCE /BEHAVIOUR		
Responsibility of customers and business	QUB	Lucy McCarthy
Place based Climate Action (PCAN)	QUB	John Barry
Developing strategies and analysing the behaviour of farmers to adaptions to climate change	AFBI	Lisa Black
Mistral ITN project (Multi-sectoral approaches to Innovative Skills Training for Renewable energy & social acceptance): examining social aspects of renewable energy development.	QUB (School of Nat and Built Environment)	
Climate change and the apocalypse: philosophical thoughts about the future and how the apocalypse might be a catalyst for starting anew	QUB	Tristan Sturm
Using climate change scenarios to develop place-based future narratives using architectural design and visualisation methods design fiction and prose/future orientated fiction	QUB	Nuala Flood
Developing strategies and analysing the behaviour of farmers to adapting to climate change. NI focus	AFBI	Claire Jack; Adewale Adenuga
Adaptation strategies at farm level – farmer attitudes and behaviours; Mitigation strategies at farm level (Farm investment)	AFBI	Clare Jack
Place based climate action network	QUB	John Barry
Empirical research with communities around climate risks, climate action, climate education	QUB	John Barry
Food shortage and poverty	UU	Sinead Furey
Passive housing (Europe)	UU	Shane Colclough
The NI longitudinal study (NILS) has a project looking at pollution data – there may be a project bring developed using the honest broker service which has anonymised health and social care data	HSC R&D Division PHA	Nicola Armstrong
The support local government to develop local sustainability development plans	Sustainable NI (charity for promoting sustainable development in NI	Nichola Hughes

Developing carbon management strategy for QUB , How can we work with researchers to develop climate change strategy for QUB and use the Estate as a living lab	QUB Estates	Sara Lynch

Output from break out discussion 2: Research gaps in climate resilience in NI

Area	Gap/opportunity identified by participants
Farming/ food	How do we embrace productivity AND sustainability in food production?
	How do we incentivise environmental outcomes?
	What are low/neutral carbon foods?
	How can we get lo/neutral carbon ruminants/agriculture?
	Eating locally - Soil fertility in different localities, nutrition requirements both have to be considered
	What are the opportunities allowing movement to a low-C economy?
	Trees – what are the potentials of urban/crop trees?
	What are new crops for climate-friendly diets?
	Addressing the over reliance on intensive livestock farming in NI – how can we diversify NI's farming landscape?
Carbon foot print/ alternative energy	Industry dentitions of carbon foot prints in products – need to make more understandable to consumers
	Carbon offsetting – need more ways for companies to make money, how do we attract capital and investment?
	Peatland sequestration – insufficient knowledge on restoration, business opportunities, hazards associated with breakdown
	How green is green energy? What is the life span of different options?
	Addressing decarbonisation of heat including transport, heating, and electricity markets
	Shallow and deep energy/heat/cooling storage potential – including 'off grid' options for homes, hospitals, and communities
Environment/ Ecology	Lack of environment data and basic ecological information
	Lack of robust monitoring of wildlife populations
	Residential heating – getting all parties involved to work together
	Biodiversity/ecosystems – need to understand the thresholds
	Understanding of fluctuations in wild animal populations, the role of weather an future projections (numerical responses)
	Lack of follow up research to see if implemented measures to improve issues (e.g. biodiversity) are actually effective
	What are the best practice examples from other places, how can these be adapted to NI (for relevant areas, such as coastal erosion)
	How can we affect the large built environment to make change?
	Effective mitigation strategies to tackle env problems created by climate change/ increased urbanisation
	What are the interaction with other human impacts on natural systems (i.e. multiple stressors)
	What are the effects on soil and plant health in the context of changing biomes and new pathogens and pests?
	Mechanistic information on ecological/species response to inform models
	Lack of baseline coastal environmental data

	Need for better modelling of the fate of pollutants in NI
	How can marine spatial planning and land use planning be integrated to protect coastlines?
	Robust analysis of biodiversity rural schemes
Policy/ economic	Linking climate scenarios to policy – understanding how those will work
	Perception of risk – estimating costs and changes
	Reconciling Gov interventions with economic outputs for businesses
	How do we make governance systems resilient?
	How do we climate-proof policy, strategies at both large and small scales?
	Defining what is a green circular economy (avoiding solutions which are tomorrow's problems)
	There are no local climate change adaptation plans in NI
	Need for risk assessments in NI based on big data approach
	How do we address contradictions of government business models of business as usual?
Funding	Data for answering long-term questions (given that Gov funding is mainly for short-term questions)
	Absence of large-scale collaborative interdisciplinary research investment via UKRI locally to facilitate regional work in climate resilience
	Funding for disaster preparedness, housing and built infrastructure climate resilience, flooding resilience research urgently required
	More funding options for interdisciplinary PhD training required
Cultural/ societal challenges	How do we stop the public from accepting ecological decline as 'normal'?
	What are the most effective ways of conveying impact, urgency, risks and uncertainties of climate change to the public?
	Climate justice – addressing concerns from vulnerable people, NIMBYs
	Transforming societal resilience – including economic and energy resilience
	Developing better understanding between social/demographic population changes and climate risks
	How do we create channels of communication from local communities to the research community (in NI and more widely)
Behavioural	Addressing challenges around behaviour, individual governance, and education – in the contexts of food, transport, and globalisation
	Public transport incentivisation – changing car dependency in NI
	Behavioural challenge not just about education – since people not unaware but resist change due to comfort/cost reasons
	Changing NI consumer habits – less consumption of animal produce to more plant based
	What are the most effective ways of conducting outreach work with communities?
Miscellaneous	Greater emphasis on multiperspectival problematisation
	Can we establish virtual networks of scientists across all disciplines within climate change and resilience? Including databases with

	researchers' details and thematic interests. This should include academic, public service, and freelance researchers
	There is a gap in research on climate education/pedagogical practices (including formal, non-formal, and informal education)