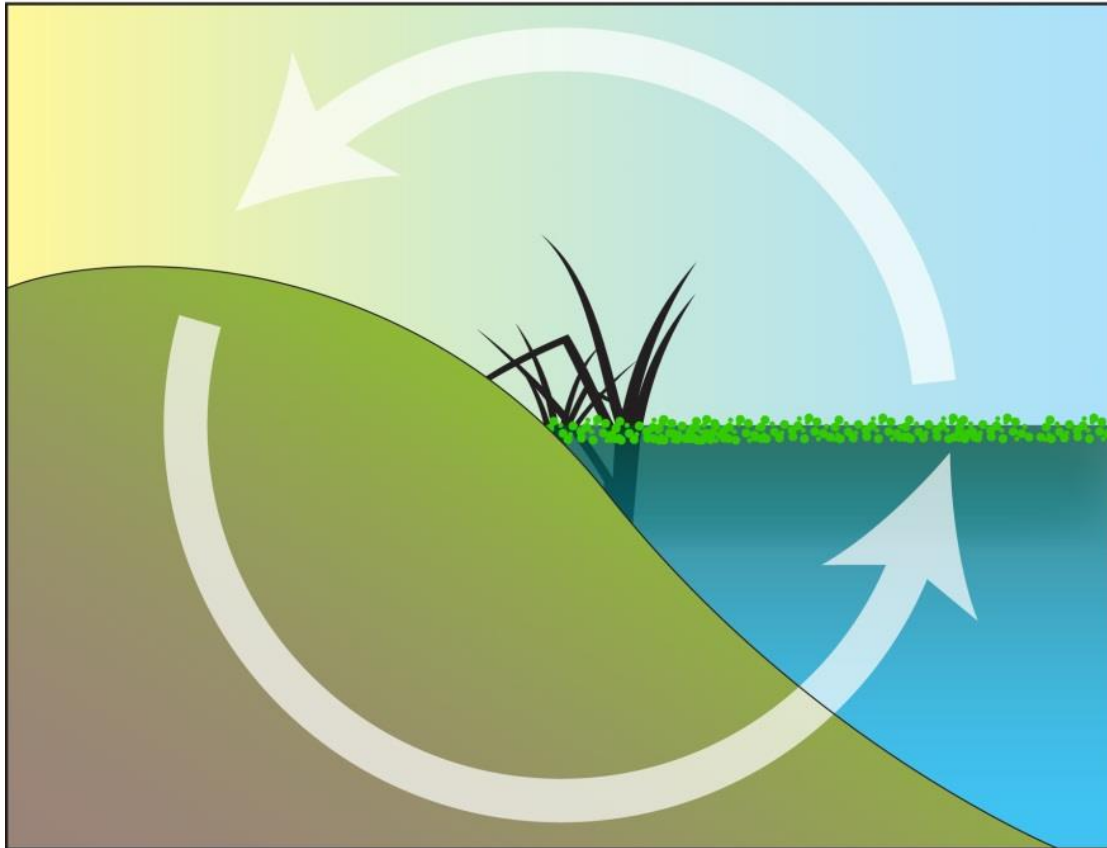


# ReBALAN:CE



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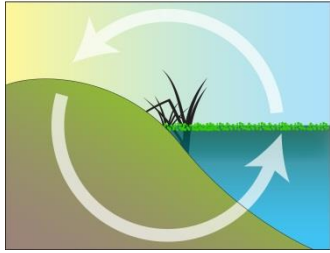
**Recycling Biomass to Agricultural LANd:**  
**Capitalising on Eutrophication**

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Horizon-scanning workshop, University of Stirling, August 29<sup>th</sup> & 30<sup>th</sup>

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# Resource Recovery from Waste (RRfW)

NERC Research Programme



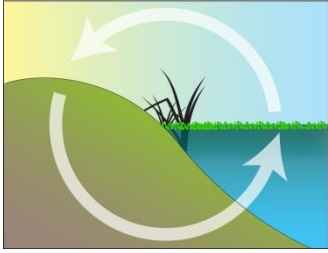
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14 Catalyst Grants

**Two themes central to the RRfW:**

**Sustainable Use of Natural Resources**

**Environment, Pollution & Human Health**



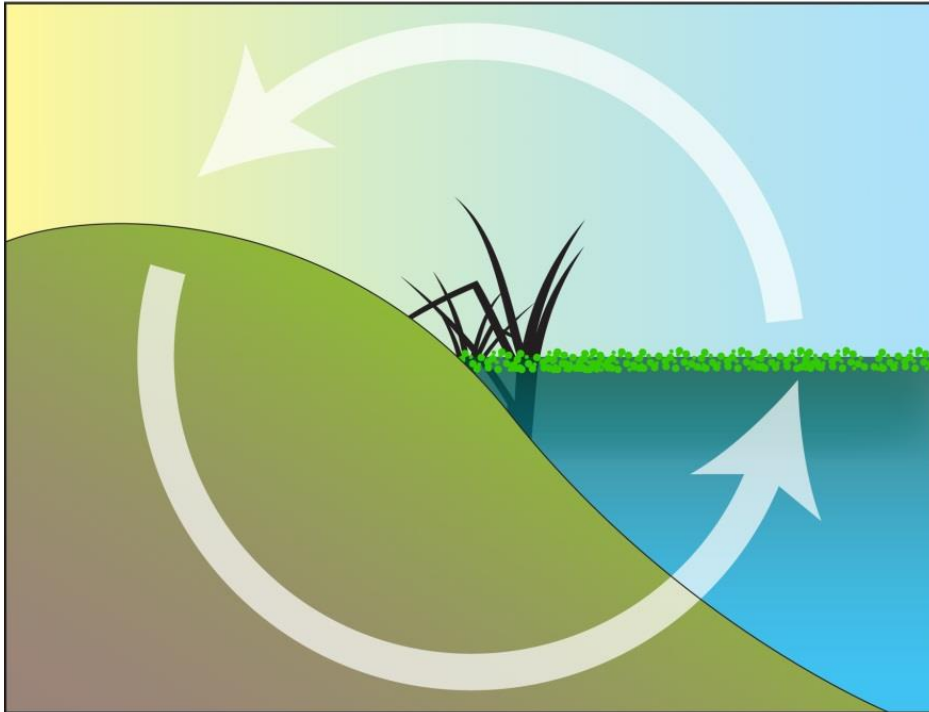
# RRfW NERC statement

Paradigm shift needed in how resources are recovered from waste..... driven by environmental benefits & by considerations of human health, not economics alone

Forge new thinking that goes 'beyond C' to understand waste as a resource from the perspective of ecological not C outcomes



# ReBALAN:CE



**Recycling Biomass to Agricultural LAND:**  
**Capitalising on Eutrophication**

Dr David Oliver; Dr Richard Quilliam;  
Prof Nick Hanley; Dr Nigel Willby;  
Dr Melanie van Niekerk; Prof Davey Jones;  
Prof Dave Chadwick; Dr Paul Cross;  
Dr Andy Vinten; Prof Paul Withers

## Project Partners:



**RESCOBIE LOCH**  
DEVELOPMENT ASSOCIATION



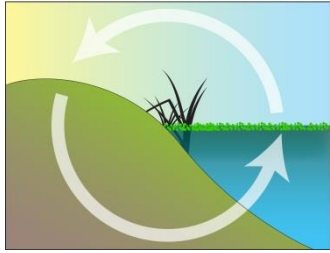
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The James  
**Hutton**  
Institute



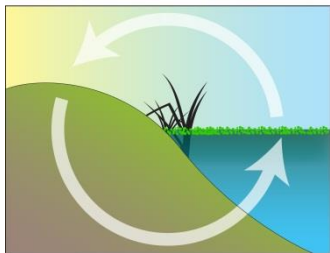
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# Catalyst Aim

Identify the breadth of key research opportunities to maximise nutrient recovery from aquatic plant & algal biomass for safe recycling to land





# Catalyst Objectives

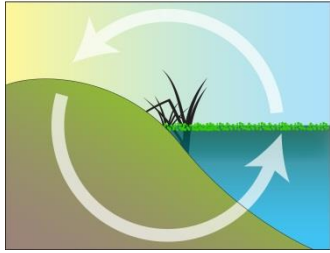
1. Foster an integrated academic-policy-stakeholder community approach for exploring risks & opportunities associated with AP&AB recycling to agricultural land
2. Undertake a comprehensive & strategic critical review of literature relating to the use of AP&AB as a sustainable fertiliser source
- 3. Identify key gaps in the existing knowledge-base & recommend interdisciplinary research priorities**



# ReBALAN:CE – moving forward

- Respond to this NERC challenge with an exciting research agenda
- A complex socio-economic-ecological system
- Integrate social, economic, environmental & health related dimensions



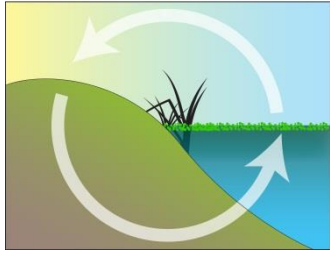


# ReBALAN:CE – moving forward

- Couple **remediation** with **nutrient recovery**
- Understand & quantify the risks, opportunities & multiple benefits of recycling excessive AP&AB to agricultural land
- ‘Close the loop’ on nutrient transfer from land to water

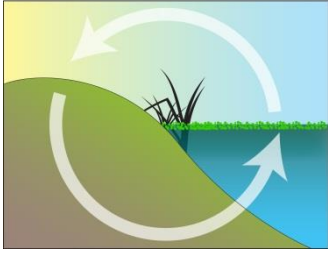






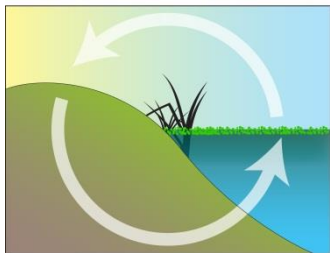
# Key issues?

- Optimising biomass processing for maximum nutrient release
- Impacts of AP&AB removal on freshwater ecology & human health?
- The potential social, economic & political barriers that could hinder the use of AP&AB as an organic amendment to soil?
- Is there potential for producing AP&AB biochar & ash products as a novel & cost-effective strategy for C sequestration & nutrient re-use?



# Conversion to a research agenda?



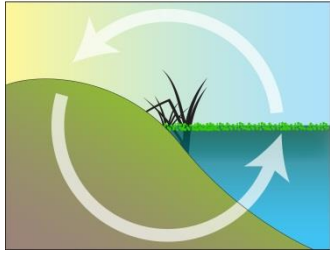


# Evaluating the potential of natural harvesting & seeding/cultivation of AP&AB in eutrophic waters

Scoping? ..... to gauge potential

Experimental assessment of potential for plants & algae to sequester nutrients & other contaminants

Matrix of water quality mitigation potential vs biomass potential as AP&AB fertiliser



# Assessing ecosystem disturbance versus potential for restoration ecology

Case study sites

Balance environmental trade-offs from AP&AB harvesting vs 'win-win' scenarios of wider ecological restoration of impacted waterbodies

Assess short- & long-term ecosystem disturbance



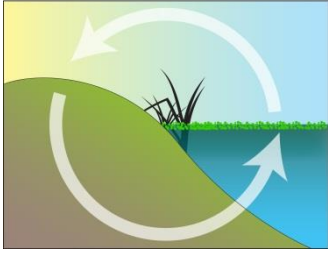
# Resource Recovery from AP&AB

Role of composting & AD of AP&AB

Optimisation of processing methods for maximum resource recovery (fertiliser/livestock feed/biofuel)

Pathogen recycling through agroecosystems?

Potential for AP&AB biochar & ash products



# **Economic viability & scaling up / Ecosystem services & life cycle assessment**

Desk-based assessments of cost of AP&AB harvesting & processing coupled with financial benefits amassed through nutrient recovery & re-use

Account for improvements to recreational opportunities, environmental aesthetics, C sequestration and bioenergy production from AP&AB harvesting.



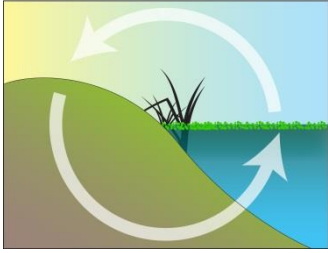
# Stakeholder & End-user acceptance

Evaluation of farming community responses

Is there a market?

Practicality & social acceptability

# ReBALAN:CE



**Eutrophication**

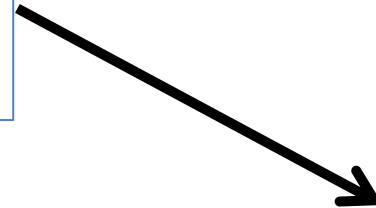
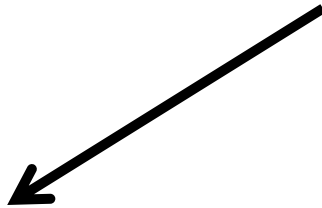


**Recovery of  
nutrients in  
AP & AB**

**Sediment  
mining**

**Biochar & C  
sequestration**

**Recycling  
back to land**



***Environmental risks***

**Water quality**

**Phytoplankton  
dominance**

**Biodiversity /  
conservation**

**Invasive species**

***Socio, politico and  
economic barriers***

**Regulatory  
issues**

**Cost (harvesting  
& processing)**

**Farmer uptake**

***Public health***

**Pathogen cycling**

**HAB and algal  
toxins**

**Heavy metals**





# Missed opportunities?

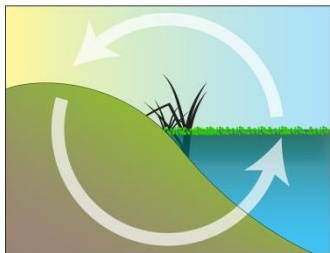
What else? Lessons to learn.....

Time & cost constraints

End-user requirements?

Reflect after presentations

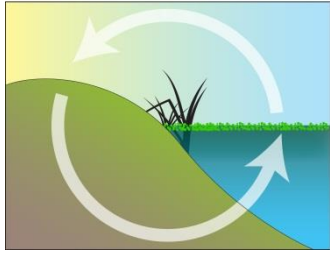




# Aim of workshop

- Share knowledge across different areas of expertise
- Critique ReBALAN:CE themes
- Agree on most pressing research needs that align with **RRfW** and **ReBALAN:CE** vision
- Networking





# By end of workshop

- Identify & prioritise knowledge gaps; exciting science & end-user needs
- Agree major research questions needed to tackle these gaps
- Initial scoping of how we might start to deliver to this research agenda
- Secure stakeholder support



# Workshop plan

- Presentations
- Q's & Debate
- Question framing
- Feasibility
- Feedback

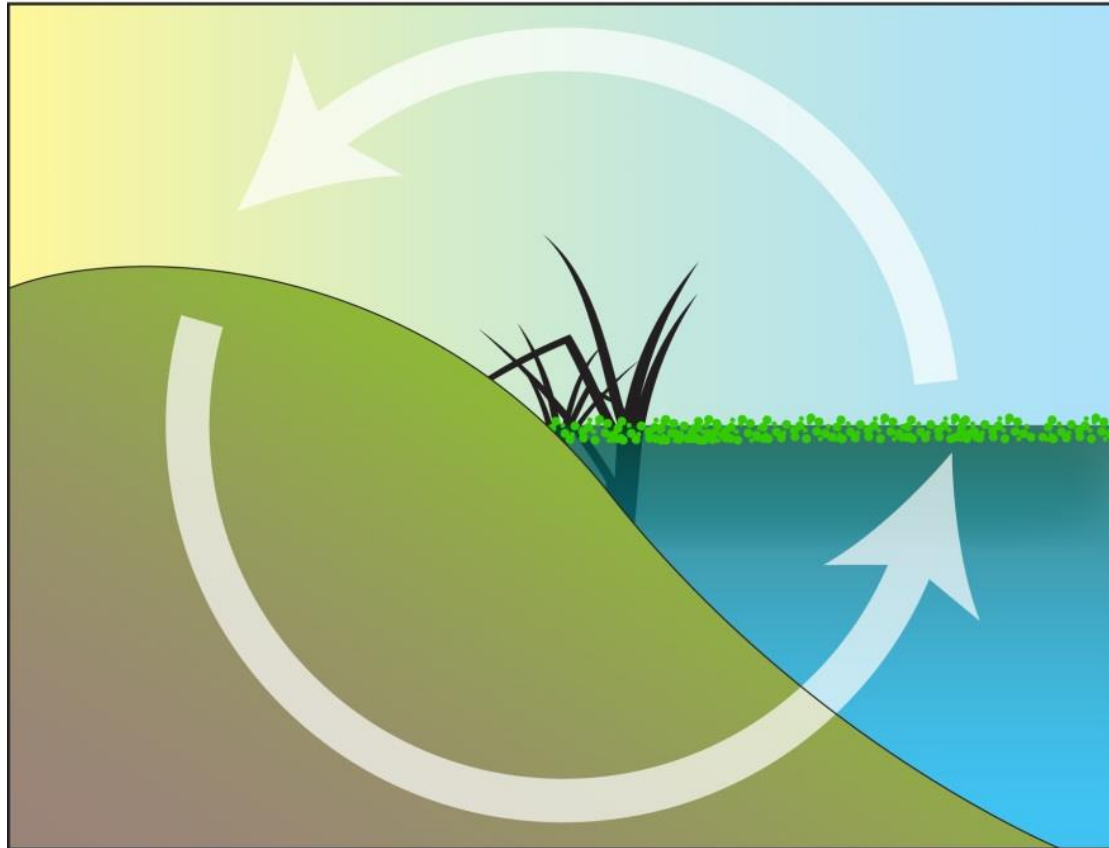


Photo courtesy of Andrea Kelly

# ReBALAN:CE



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