Research for the Future of the Broads Resilient Peatland

27 June 2017

Notes from SESSION 2: Fen Research Workshop

Venue: Dragonfly House, St James Place, Norwich NR3 1UB

Steering Group: Broads Authority, Natural England, supported by Mike Harding (Hummingbird)

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Under A-E headings, the numbers refer to the questions posed prior to workshop and the lower case letters and bullets record the discussion at the workshop around these questions (the notes are divided into: Note, Principle, Partner Action and Research)

A. Natures benefits (economic and social) & Sustainable fen management (commercial cutting, biomass/soil improvers)

1. Given that the main services of fens include nature watching, carbon storage, water purification, flood prevention and biomass production what further research is required to assess these values?

    a. Note: that splitting out fen is difficult e.g. data is Broads wide for tourism

    b. Partners Action: Define what needs to the done to retain/increase natural capital value, by building on e.g. Biodiversity 2020 IC Ecosystem Assessment for the Broads

    c. Partner Action: Engage the private sector with natural capital values, and re-invent the LNP to do this in accordance with its original purpose.

    d. Research: Assess our local 'dependence' on these values to improve and target communication

    e. Research: Use EA model to map enhanced groundwater recharge areas that benefit the Broads wetland/fen habitats through increasing infiltration and harvesting rain via rural SUDS to lead to greater awareness and targeting

    f. Research: Investigating microbial processes within fens that could be used for wider water treatment benefits

    g. Research: Mapping areas of cut peat (turburies) for assessing the historic peat resource and assessing against fen plant communities, particularly the distribution of sphagnum

    h. Research: Assess the baseline greenhouse gas emissions from new Broads wetland creation projects to compare with future emissions

2. What methods and tools can be developed to support advocacy of fens, their value to society and their requirement for conservation?

    a. Note: Is the 'most biodiverse' tag pushed hard enough? Suggestions of general publications to relate to people, create fun and fascination

    b. Note: Create a clear purpose and definition of the audience to improve the marketing of biodiversity to reinforce the economic case

    c. Partners Action: Increase social media

    d. Research: Create specific local quantitative values of peat fen to society

    e. Research: Assess and create virtual experiences for wetland sites and opening wider access as appropriate

3. Research on how the public perceive fens and their conservation would be a useful basis for further public engagement work. Perceptions should be assessed for particular audiences both local to the fens and those more distant.

    a. Note: Emphasis should be on 'local perceptions' rather than 'public perceptions'

    b. Research: Assess how fens/wetlands are marketed in EU and globally (e.g. via key species such as beaver, canoeing etc) (link to 2b)

4. How can a viable market for fen management arising's be secured?

    a. Partner Action: Support for: paludiculture (wetland agriculture) and sustainable management practices e.g. via Canape

B. Re-creating fen for a wide range of values, including rare, complex, species-rich or distinctive biodiversity

1. Which substrates promote restoration of high quality fen, and what are the key characteristics (e.g. bare chalk or gravel/sand with calcareous spring flow as in Dry Sandford Pit in Oxon where fen has developed over the last 100 years)?

    a. Partner Action: Re-find and recreate areas of M5 Dryopteris-type community

    b. Research: Collation of existing knowledge to examine how fen communities have developed following restoration of groundwater flows and habitat management

2. Can these key site characteristics be re-engineered once lost or degraded?

    a. Research: Assess the local seedbank to assess the germination potential under different conditions

    b. Research: Investigate the value of seeding newly created wetlands with fen seed/substrate/moss

3. How can the re-assembly of species-rich or distinctive fen types be encouraged once environmental conditions have been stabilised?

a. Research: Collation of existing knowledge to examine how fen communities have developed following restoration of groundwater flows and habitat management

b. Note: NERC research on molecular assessment of re-wetting peat by 2020 by Nicole Bell, Edinburgh

4. Which management techniques are required to restore degraded fen types to species rich complex fen types?

    a. Note: probably know the answers, the key is to establish the cause of the degradation (succession or water quality/quantity)

- Partner action: Recreating fen is urgent, and requires partnership work and leadership to find suitable areas and funding linking to creating natural benefits (A)
- Note: Management of expectations is required; recreation can't be done in normal 5 year plan programmes
- Note: Be aware that sustainable natural communities development, based on the environmental conditions and an element of randomness, without specific aims can be useful

C. Peatland functioning and response to long term change in sites - water supply (acidification, drying)

Catch dykes and connectedness

1. Visual mapping to demonstrate the scale of the situation, including adjacent land use
2. How are catch dykes affecting individual sites with differing eco-hydrological regimes and varying catchments?
3. How do fen communities respond to catch dykes projects?
4. What is the function of fen dykes and micro-topography in maintaining in-field fen conditions, in terms of both water quality and water levels?
5. How is connectedness best managed to optimise fen ecological condition in particular confirmations of dyke network, river flows and fen topography?
6. What is the eco-hydrological functioning of pioneer swamp communities, and how do they affect shallow lake hydrological processes, including hydrochemistry?

    b. How do we get pioneer swamps communities restarted

- Partner Action: pilot and monitor catch dykes to inform understanding and consider simply making them shallower and taking them out of routine clearance/maintenance if outcome is likely to be favourable

Acidification

7. What is the new framework for making balanced, and evidenced based, ecology and water supply decisions? How can we work together to improve condition assessment?
8. What are the key habitat characteristics which support poor-fen and transition mire in the Broads?

9. Which WetMecs (sensu Wheeler et al 2009) accommodate acid noda?
10. Create a conceptual model to include the development of fen succession/development to include acid communities
11. Is the frequency of acid noda increasing, what is this rate of change and is the extent of existing locations increasing?
12. What are the floristic relationships between acid noda and their surrounding vegetation types? Are the floristics of particularacid communities correlated with the floristics of the surrounding fen community, or largely independent of it? What is the nature of the gradation between the two – sharp or diffuse?
13. What is the role of management, particularly scrub removal and vegetation cutting, in maintaining acid communities via e.g. affecting the upwards movement of water?
14. How should the potential conflict between expanding transition mire and declining rich-fen be resolved?
15. How can oxygen status be measured easily and thus be related to groundwater flows?
16. Development of strategic guidance on acidification/calcareous desirability

D. Peatland functioning and response to long term change - Water chemistry (enrichment, salinisation)

1. How are nutrients and salinity routed through fen compartments? What factors aid movement of hydro-chemicals, what inhibits them, can these be predicted?
    a. Partner Action: prioritise sites to do this study
    b. Research: Use an integrated data collection and modelling approach in the context for looking back at the antecedent conditions and assessing the time we have for the sites to remain at these conditions and rates of expected change (e.g. NVZ work, accretion and sea level rise)
2. What are the nutrient and solute budgets of individual fens? Can individual plant communities be assigned nutrient budgets within larger fen complexes?
    a. Note: this is not realistic/too difficult for individual fen sites. We already have nutrient levels and salinity (B. Surridge work for Strumpshaw)
    b. Principle: the focus should be on making sites as best as possible and creating resilience
3. How do different fen communities respond to different levels of nutrients and salinity? Which species are particularly vulnerable?
    a. Note: this could be interesting for some groups that have not received a great deal of attention and could help with understanding of species distribution (e.g. molluscs regarding salinity change). Are the Ellenburg values sufficient for vegetation?
4. What is the function of fens in moderating or buffering diffuse catchment nutrient flows to shallow lakes? What are the characteristics of fens which store catchment nutrients, and what are the characteristics of

fens which contribute nutrients? What are the trade-offs between fen and lake conservation when considering using fens as shallow-lake buffer habitat?

   a. Principle: Fens are not treatment wetlands!

   b. Note: This context is not appropriate and unlikely to be effective as the river influence is too big. Tackling the source of the nutrient.

5. What management strategies can be deployed to mitigate harmful levels of nutrients or salinity?

   a. Partner Action: to review each site for the ease of ingress of flood water and speed of removal of saline from sites and if required collate this knowledge on a map

- Research: Investigate the application of a new technique for sampling substrates using electrical conductivity measures

- Research: Assess the seasonal variability and fluxes of water

E. Succession management (grazing, cutting, digging)

Grazing

1. What is the nature of the relationship between grazing and fen habitat structure and microtopography? Are there similar relationships for invertebrate communities, and are the resultant habitat structures and invertebrate communities correlated or independent?

2. What are the effects on peat structure and shallow peat hydrology of different grazing strategies? Are the impacts on peat structure and hydrology different in wet fens compared to dryer sites?

3. What is the effect of stock manuring on available nutrients at the fen surface, and what is the role of hydrological processes (e.g. rainwash) and surface flooding in distributing such nutrient?

4. How do deer affect the ecology of fens? Is there an interaction with domestic stock? Should deer herds be managed?

5. What are the dietary preferences of livestock when grazing fens? How does this vary between cattle/sheep/ponies and deer (and perhaps between breeds). How would this knowledge inform grazing regime to achieve management objectives?

6. In what ways do grazing patterns for a particular stock type vary between fen types – reedbeds, sedgebeds, mixed fen, acid fen, fen meadows etc? How does such knowledge influence specific grazing prescriptions?

7. Are observational studies undertaken on Broadland fen sites, evaluating diet, habitat partitioning and the impact of different stock types and grazing densities, a useful approach to elucidating the above questions?

8. What is the impact of switching from traditional mowing to grazing management on specific communities?

9. Which grazing regimes optimise fen invertebrate communities in different fen types?

10. How do grazing animals distribute plant propagules, including invasive species? Are wildfowl significant vectors of plant propagules?

- Research: Experiment to assess the outcomes of cutting and grazing
- Note: the grazing questions set out prior to the workshop are 'too specific'

Cutting

11. Is traditional, manual management as low-impact as has been assumed? How does this compare with grazing stock or use of low ground pressure equipment such as the fen harvester?
12. What are the impacts of different mowing regimes on different Broadland fen types? The sub-communities of S24, hover vegetation, M9/M13 analogues, BS5 *Dryopteris cristatus-Sphagnum* fen and distinctive communities such as transition mire and early successional swamp would be priorities.
13. What is the minimum level of mowing effort required to meet a conservation objective for a given community?
14. Given the existing research on fen mowing regimes, can they be further optimised for invertebrate interest, across different fen habitat types?
15. Given the existing knowledge on the effect of burning winter cut material, will further research help take the issues facing the fens?
16. How can small scale mowing management be scaled up to the landscape scale? What is the best pattern of mowing and non-intervention to optimise for all species in, say, a whole river valley?

Digging / Maintaining the hydrosere

17. Can an experimental approach identify which initial site conditions produce the highest quality fen communities following turf pond excavation?
18. What turf pond design features (size, depth, shape etc.), and what post-excavation management, is required to establish high quality fen communities?
19. Should we be re-excavating old turbaries, or excavate on adjacent undug peat?
20. What factors are limiting the natural re-establishment of the aquatic-to-early terrestrial transitional fen types? What is the relative importance of such factors?
21. How can the initiation of this early phase aquatic-terrestrial succession be engineered?
22. What processes govern the re-assembly of more diverse and distinctive fen types from the very early successional swamps? How can the process be managed?
23. What are the mechanisms for hover to establish? Do different species respond in different ways? Can the processes be successfully managed?

24. What is the likely conflict with (paleo) archaeological interests when digging into cut and uncut surfaces?

- Principle: Support underpinning processes and embrace dynamism, particularly around habitats that prove unstainable to continue management
- Partners Action: could large scale peat extraction be permitted/affordable/desirable to create early successional stages over the short and medium term
- Partners Action: Share anecdotal evidence in Conservation Evidence
- Research: Modelling what a landscape managed to protect natural services, including non-intervention and rewilding concepts, would look like in the Broads and the species and habitats that would be maintained

Actions recorded at the workshop

	A. Natures benefits (economic and social) & Sustainable fen management (commercial cutting, biomass/soil improvers)	Lead partner (other partners)	Timescale
1	Marketing the importance of fens to targeted audiences via Canape (using a campaign programme) and link to IUCN UK Peatland Strategy Assess our local 'dependence' on these values to improve and target communication Assess how fens/wetlands are marketed in EU and globally (e.g. via key species such as beaver, canoeing etc)	BA (Broads Biodiversity Partnership)	2018-22 Canape
2	Stimulate innovation for local markets for fen arising's, link with knowledge transfer and innovation funding	BA, SWT (Anglian Water, Broads Biodiversity Partnership)	2018-22 Canape 2017-21 Water Mills & Marshes
3	Collaborative approach to visitor survey to identify the perceptions and values of fen Informed by CANAPE project. UEA student questionnaire talking to public to get base level information on perceptions and values of fen.	UEA, BA, Reaching groups incl. Broads Biodiversity Partnership, Broads Forum	June 2017 – April 2018
4	Link business and natural capital for 'future fens' for mutual benefit	BA Canape (with links to LNP, LEP)	
5	Define what needs to the done to retain/increase value, by building on e.g. Bio 2020 IC Ecosystem Assessment for the Broads Landscape scale work looking at all natural benefits. Framework in CANAPE for partners to assess.	BA	2018-22 Canape
6	Use EA model to map enhanced groundwater recharge areas that benefit the Broads wetland/fen habitats though increasing infiltration and harvesting rain via rural SUDS to lead to greater awareness and targeting	EA/NE/BA (Broads Biodiversity Partnership)	
7	Investigating microbial processes within fens that could be used for wider water treatment benefits	Academic lead	
8	Write a specification to map areas of cut peat (turburies). Find a GIS student to look at historic maps, coring data and finding out where turburies are.	MSc, with BA and Jo Parmenter	

9	Assess the baseline greenhouse gas emissions from new Broads wetland creation projects to compare with future emissions Could NWT/SWT projects fit this action? Queen Mary University London looking for £3k for case funded PhD, worth building into funding bids. Doctoral training at UEA – redesign of future years aligning academic and business needs.	Doctoral Training Programme (DTP) or CASE funded PhD from Broads Biodiversity Partners	

	B. Re-creating fen for a wide range of values, including rare, complex, species-rich or distinctive biodiversity	**Lead partner (other partners)**	**Timescale**
1	Collate unpublished literature and knowledge Breaking down this action further would help. RSPB are collating research literature on water chemistry and fens and will report on a defined scope and a report to the next meeting. Ditch water chemistry data could be collated. NE also to collating data, and will check grazing marshes/dykes that has already been collated.	BA intern, Academic UEA, Conservation Evidence project (2018) (Broads Biodiversity Partnership)	2018-22
2	Re-find and recreate areas of M5, M9, BS5 community (needs further confirmation)	NE with support from RSPB	
3	Investigate the value of seeding newly created wetlands with fen seed/substrate SWT to note Plantlife position about seeding and confirm if there is a clearly defined MSc or undergraduate project	Wildlife Trusts (Broads Biodiversity Partnership)	
4	Assess the viable seedbank in fen peat Research questions need to be formed	Academic PhD	2018-22
5	Evaluate the resilience and recipe for creating new fens in relation to achieving integrated outcomes in a changing environment Sites include: Ranworth flood, Lakenheath, Watermill Broads, Oxborough fen Monitoring revisits of fen restoration projects Sites include: scrub removal sites and complete turf pond data collation and assessment Academic research needs to be defined	Plantlife lead Academic	Immediate
6	Monitor and assess the change in Catfield Fen and surrounding area in response to change in groundwater abstraction regime. (relate to	RSPB,	Immediate

	acidification questions) Collaborative monitoring being carried out around Catfield and Sutton, subject to funding	landowners	

	C. Peatland functioning and response to long term change in sites - water supply (acidification, drying)	**Lead partner (other partners)**	**Timescale**
1	Joined up approach to monitoring including meeting, data share, monitoring methodology protocols (for vegetation and water) and future planning	NE, BA, EA (Broads Biodiversity Partnership)	Immediate
2	Update map locations of sphagnum and crested buckler fern communities using existing data to target locations and then experiment with novel technology such as drones	Broads Biodiversity Partnership (BA, RSPB drones)	Immediate
3	All catch dykes identified and put into types by NE. Report published. Pilot and monitor catch dykes to inform understanding and consider simply making them shallower and taking them out of routing clearance maintenance if outcome is likely to be favourable	NE NE (Broads Biodiversity Partnership)	2017/18
4	Develop a guide on the acidification of fens from one target community to another	NE (person to be identified)	2018/19

	D. Peatland functioning and response to long term change - Water chemistry (enrichment, salinisation)	**Lead partner (other partners)**	**Timescale**
1	Work together to review the EA monitoring network for fens in East Anglia and justification for retention for the network	EA (Anna Sharpin/Anne Ramsey)	June – Sept 2017
2	For the EA monitored sites and other long-term vegetation monitoring sites, develop a protocol for collection of enhanced data that could be used by e.g. volunteers or conservation organisations	NE, EA	2017/18
3	Select sites for enhanced monitoring - NE at risk sites to be shared	NE, EA, BA	2017/18
4	Create an inventory of existing or future habitat management operations that could be researched and send this to Universities	Broads Biodiversity Partnership	2017/18
5	Use an integrated data collection and modelling approach in the context for looking back at the antecedent hydrological conditions and assessing the	Doctoral Training Programme	

	time we have for the sites to remain at these conditions and rates of expected change (e.g. NVZ work, accretion and sea level rise)	(DTP) or CASE funded PhD from Broads Biodiversity Partners	

	E. Succession management (grazing, cutting, digging)	**Lead partner (other partners)**	**Timescale**
1	Share wetland management evidence in Conservation Evidence (note: wetland synopsis is due in September)	In progress	IUCN, BA
2	List priority research projects from those listed and share with students and interns	Broads Biodiversity Partnership, UEA, academic partners	2017/18
3	Build future monitoring into agri-environment funding	NE	2019
4	Modelling what a landscape managed to protect natural services (including non-intervention and rewilding concepts,) would look like in the Broads and the species and habitats that would be maintained	Broads Biodiversity Partnership	
5	Experiment to assess the outcomes of cutting and grazing PhD chapters: historical, experimental work now/comparison. Introduced wholesale/not much historical comparative data. Opportunity if a Broads wide vegetation survey could be focused to answer grazing question.	Doctoral Training Programme (DTP) or CASE funded PhD from Broads Biodiversity Partners	