Fen workshop
Research for the Future of the Broads
Resilient Peatland

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Broads Authority 27 June 2017

Broads Biodiversity Partnership

Environment Agency | RSPB | Suffolk Wildlife Trust | Norfolk Wildlife Trust | Natural England | Broads Authority

Aim of the workshop

- Sharing latest knowledge
- Forming the fen research questions
- Prioritising research, communicating it's impact to academics and practitioners
- Linking priority Broadland fen research with national research and knowledge exchange opportunities

How to achieve biodiverse fens?

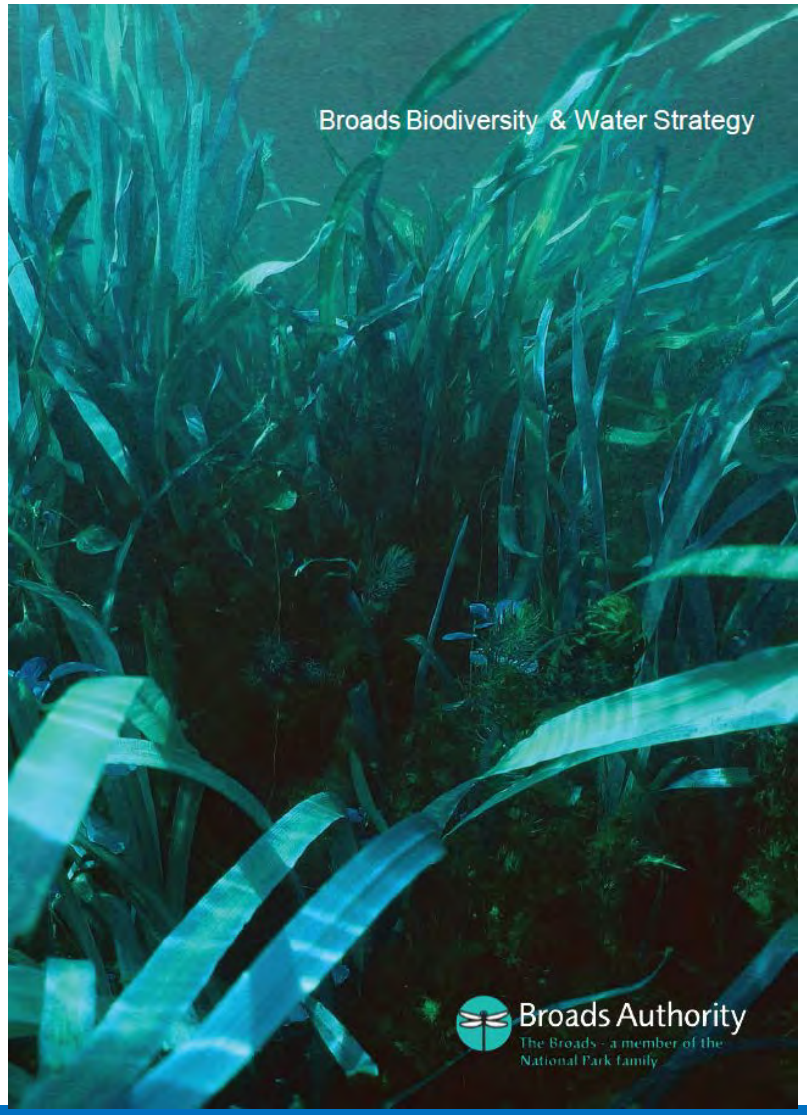
4 strategy areas

Creating and enhancing

Protecting

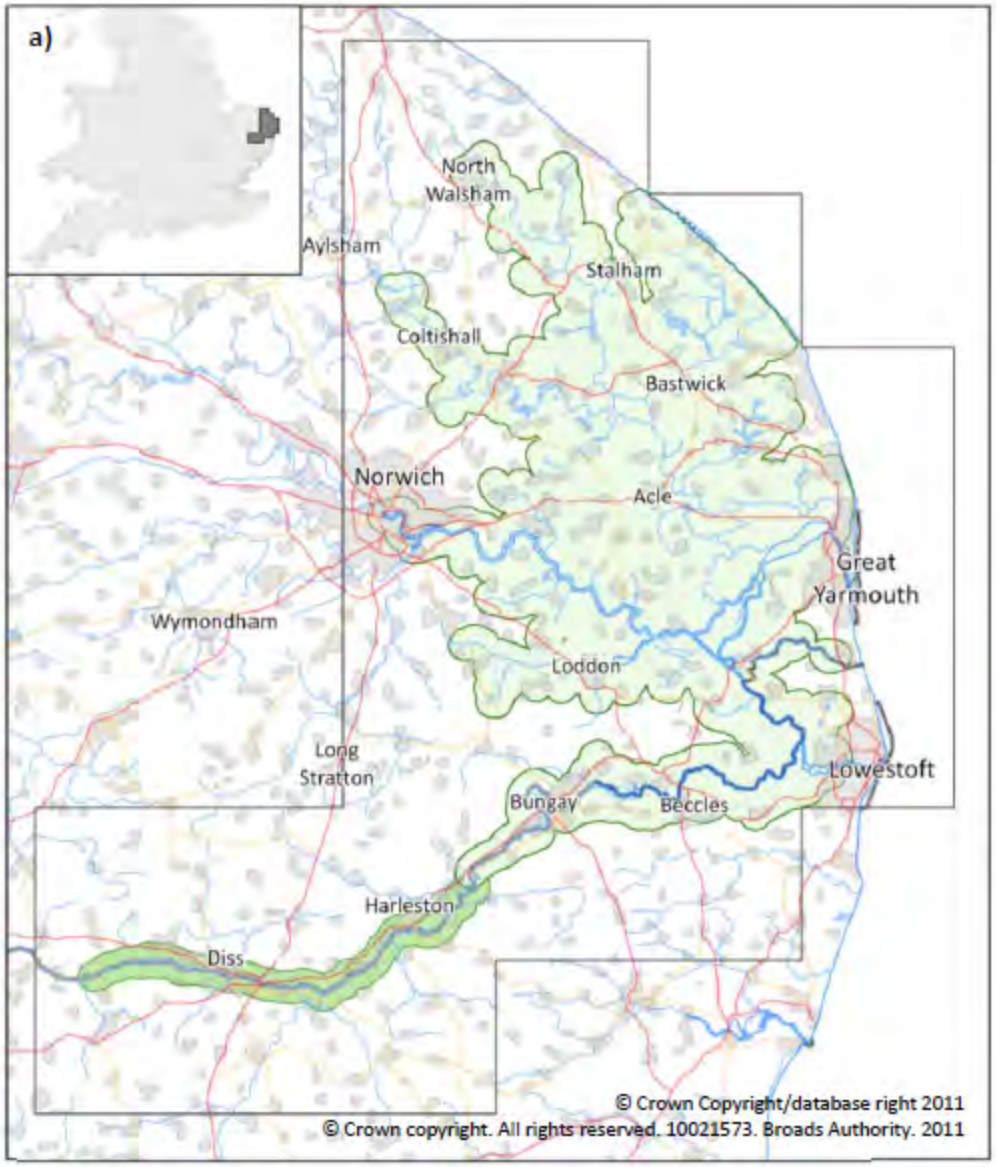
Understanding

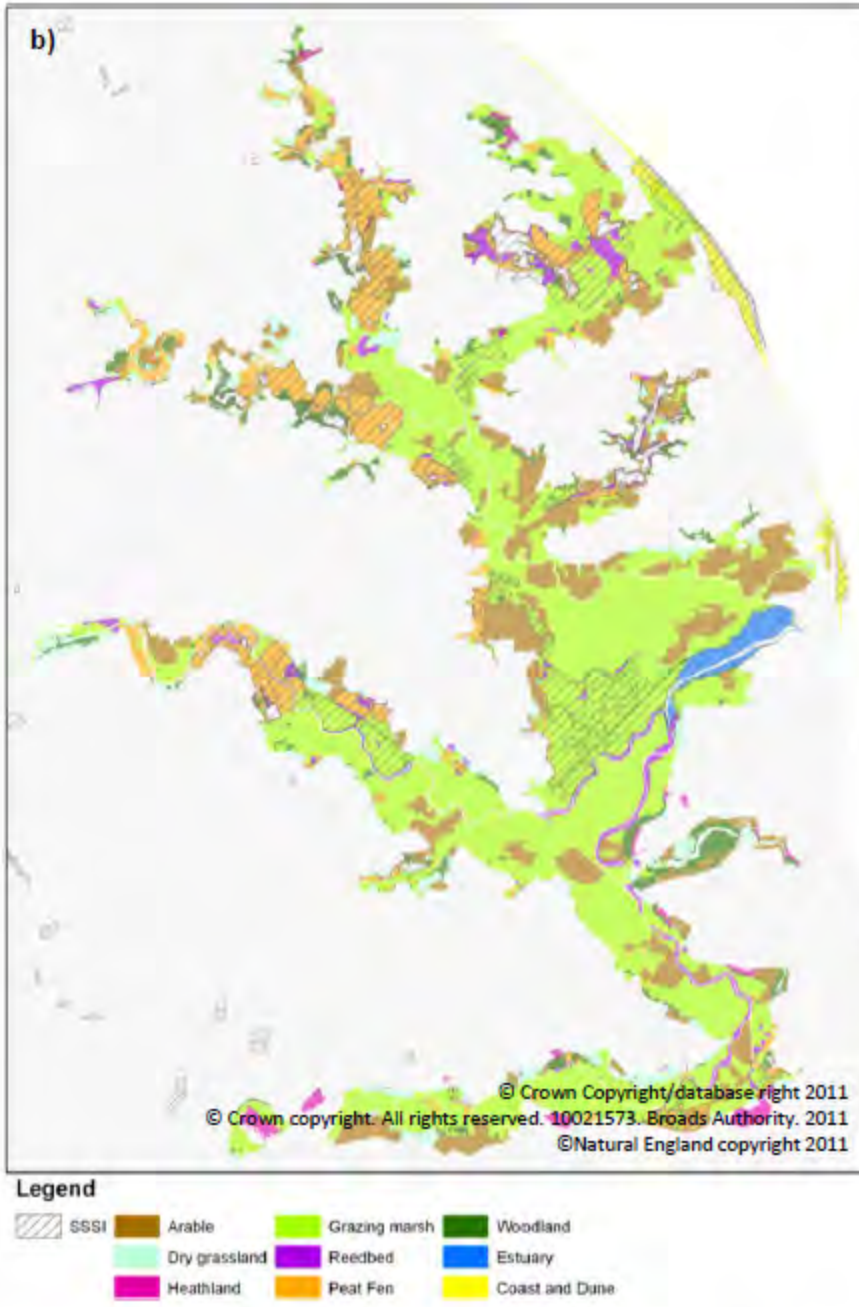
People engagement



Context

- Agri-environment support
- Fen Management Strategy (1997) has been achieved
- Two major fen surveys have demonstrated biodiversity loss/gain
  - Species of conservation concern at threat (e.g. water beetles, lesser water plantain, fen orchid, fen pondweed), recent gain (e.g. Norfolk hawker, water soldier, fen raft spider)
- Share knowledge between ecology and hydrology disciplines
- Apply knowledge across sites
- Catfield Fen Public Inquiry 2016 - water abstraction - comprehensive evidence base, informed by leading wetland experts





gure 1. The Broads study area showing a) the location of the Broads within the UK (inset) and within the region, the location of urban centres, major roa

What we know.

Our Insights and the sources of data

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Insight 1

UK's richest biodiversity

The Broads Biodiversity Audit 2015 concluded that fen habitat supports the greatest biodiversity (both species number & number of conservation priority species)

Sutton & Catfield

Flowering plants (27 red listed, 18 Nationally Rare or Scarce)
Coleoptera (32 red listed, 147 Nationally Rare or Scarce)
Moths (14 red listed, 67 Nationally Rare or Scarce)
Diptera (23 red listed, 111 Nationally Rare or Scarce)

Exceptional national importance for these groups

Richness needs the building blocks of water supply, water quality, peat health and a mosaic of good management

Sources: Biodiversity Audit (UEA). Site Management Plan

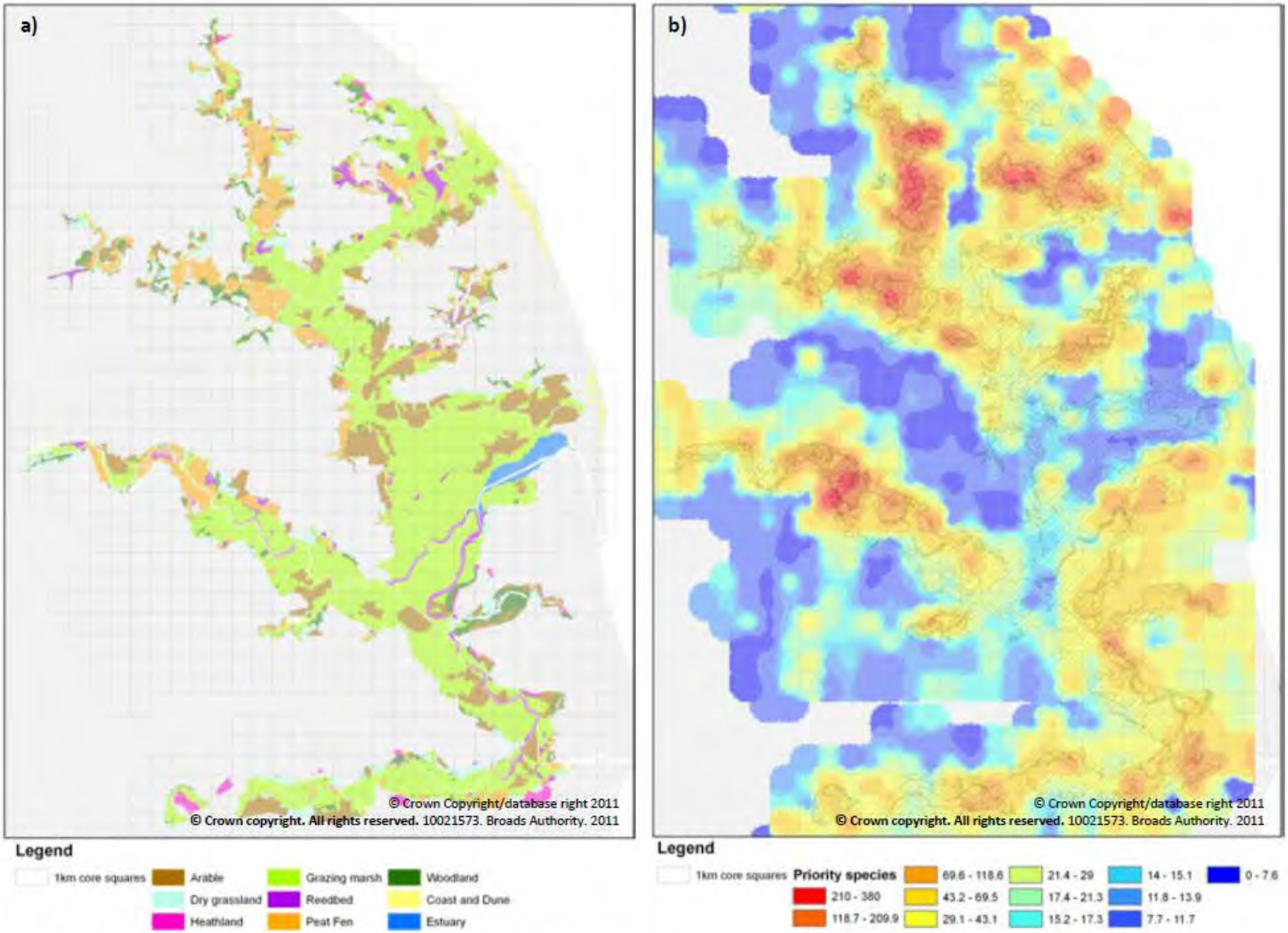
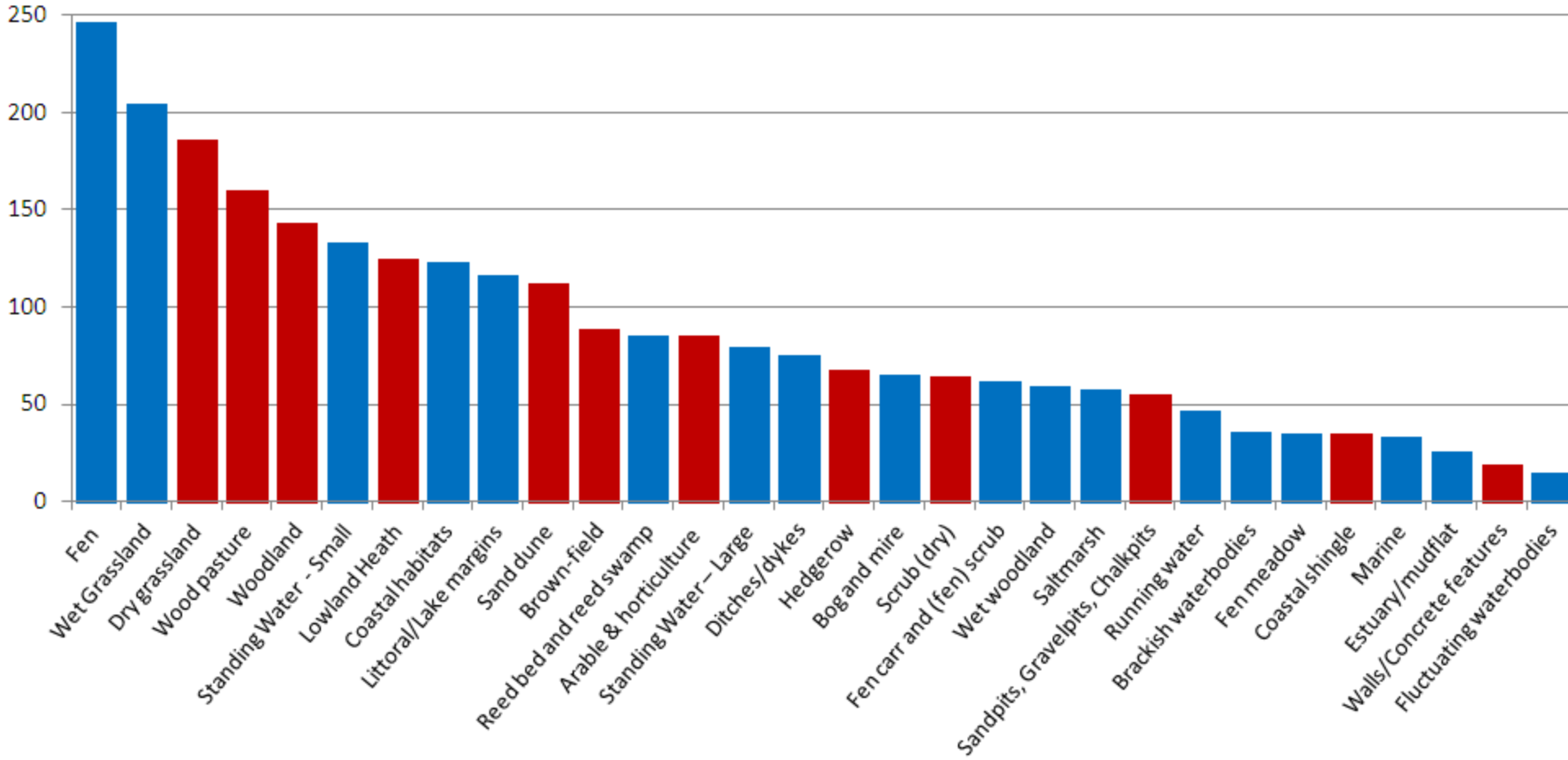


Figure 9. Distribution of a) habitat types, as classified by the Broads Authority, b) priority species, with habitats shaded for cross reference between maps

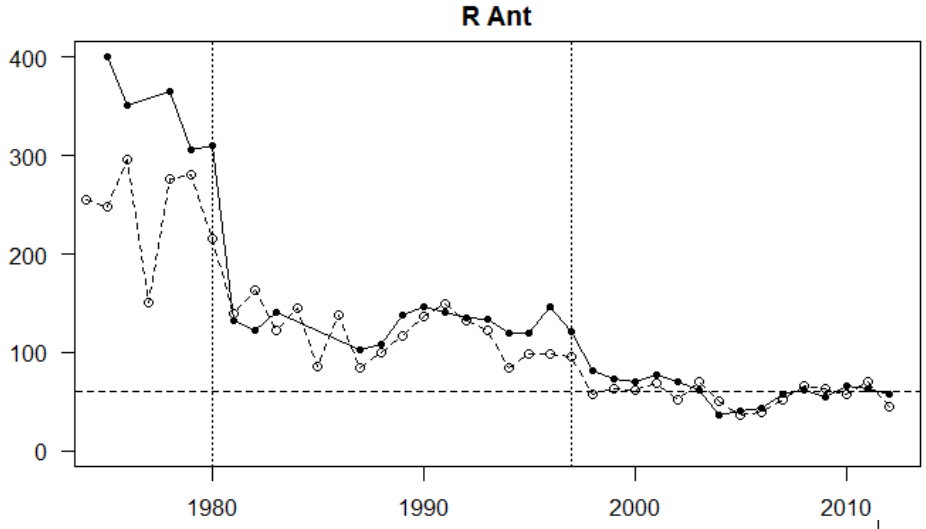
The relevant importance of habitats based on priority species associations



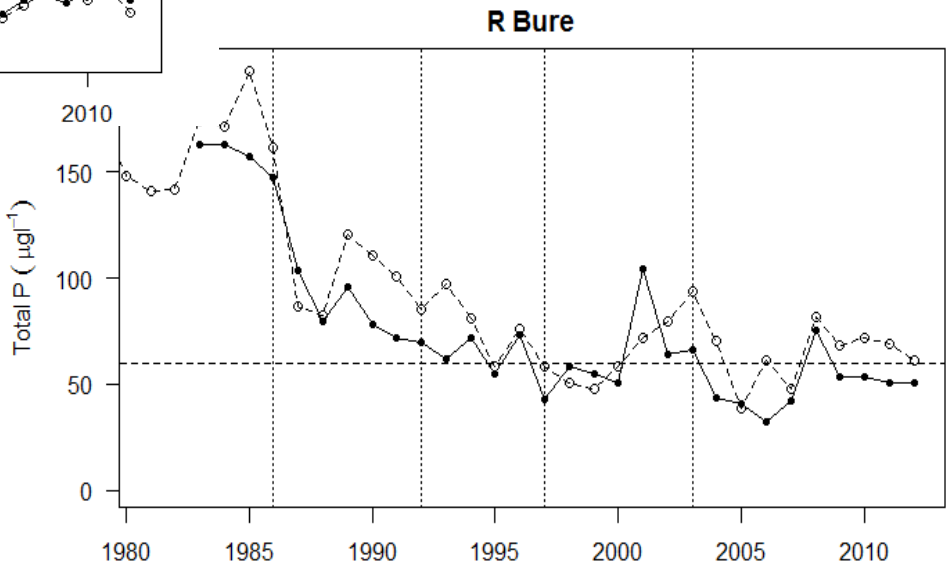
Blue = wetland habitats
Red = non-wetland habitats

Insight 2

Elements of river water quality have improved.



TP concentrations stabilise at ~60ug/L and have not changed significantly since 2003



TP achieved is too high to translate to the ~30ug/L target for chlorophyll needed to achieve macrophyte dominance

Source: Lake Review 2015

Insight 3

Clear **evidence of negative change**

a) loss of pioneer swamps and upland transition habitat

b) loss in species richness to sites dominated by common reed

c) fewer wet fen areas, shown by the loss of important turf-pond communities

d) nutrient enrichment is still an issue, partly due to;
   a) succession to woodland
   b) water quality and quantity

e) increasing salinity on the ronds and fen sites – new challenge

Source: Fen Survey 2007-10

Insight 4

Need better routine monitoring of vegetation change

- Natural England's **Condition Assessment** could be revised to pick up more details of negative changes before until it is too late
- Moving from regular to risk based surveys a problem?

For example: Evidence suggests that monitoring selected points at high priority sites, would identify changes in the fen at a much earlier stage (Catfield)

Source: Fen Condition Report (BA/NE), Parmenter

Insight 5

The only long term data collection is hydrology monitoring & river water quality

We rely on the hydrogeological model

More focus needed on fen vegetation change

Source: Multiple sources, incl. Bradley and Barendregt

Insight 6

Limitations of data in the microenvironment of wetlands

- Good field data is required to input into and test the EA model
- Limitations on estimating pH changes, O_2, phytotoxins
- Model predicts water levels, need micro-topography and substrate permeability assessment to accurately predict the moisture at given points and variations in the source of waters in the rooting zone
- Assessments are too large for a realistic assessment of a Broadland fen microenvironments

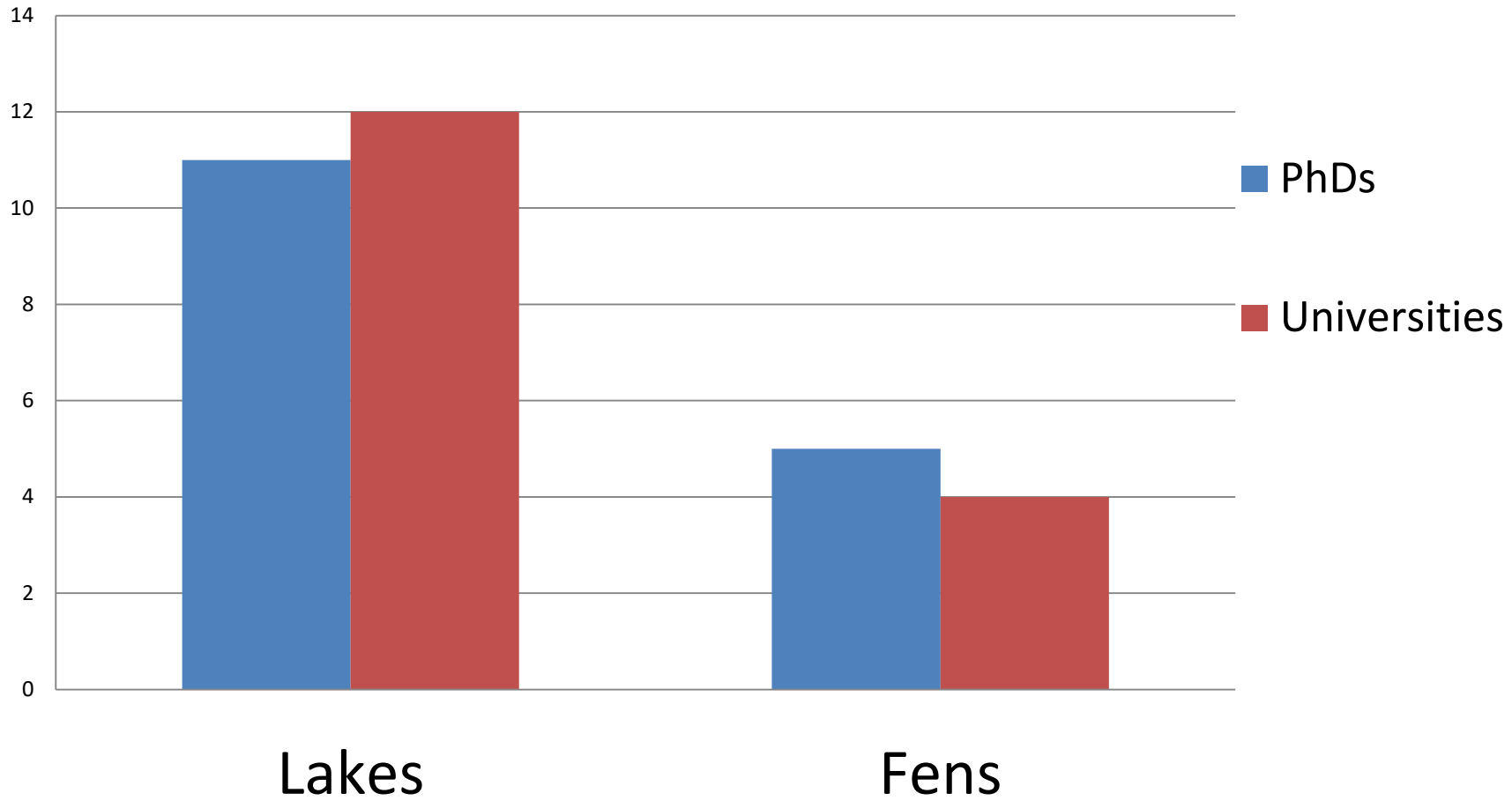
Source: Catfield Fen Public Enquiry, Plantlife

Insight 7

More strategic approach to collection of new long term data

- Synergy between statutory and voluntary monitoring needs to be explored
- The role volunteers and citizen science is not clearly defined
- Better use could be made of existing volunteer data collection

Insight 8 There appears to be less research in the Broadland fens



Insight 9

Fen grazing and the effect on substrate and community is not well understood

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Insight 10

Adaptation, natural function needs consideration

Site based research could help decision making for adapting to environmental change and creating better natural habitat function

Source: A narrative for conserving freshwater and wetland habitats in England (NERR064)

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Applied Research Focus

- Support decision making (strategy & management)
- Provide rationale for funding fen management
- Focusing on the questions which make the biggest difference to fen management (water management and policy)

Afternoon workshop

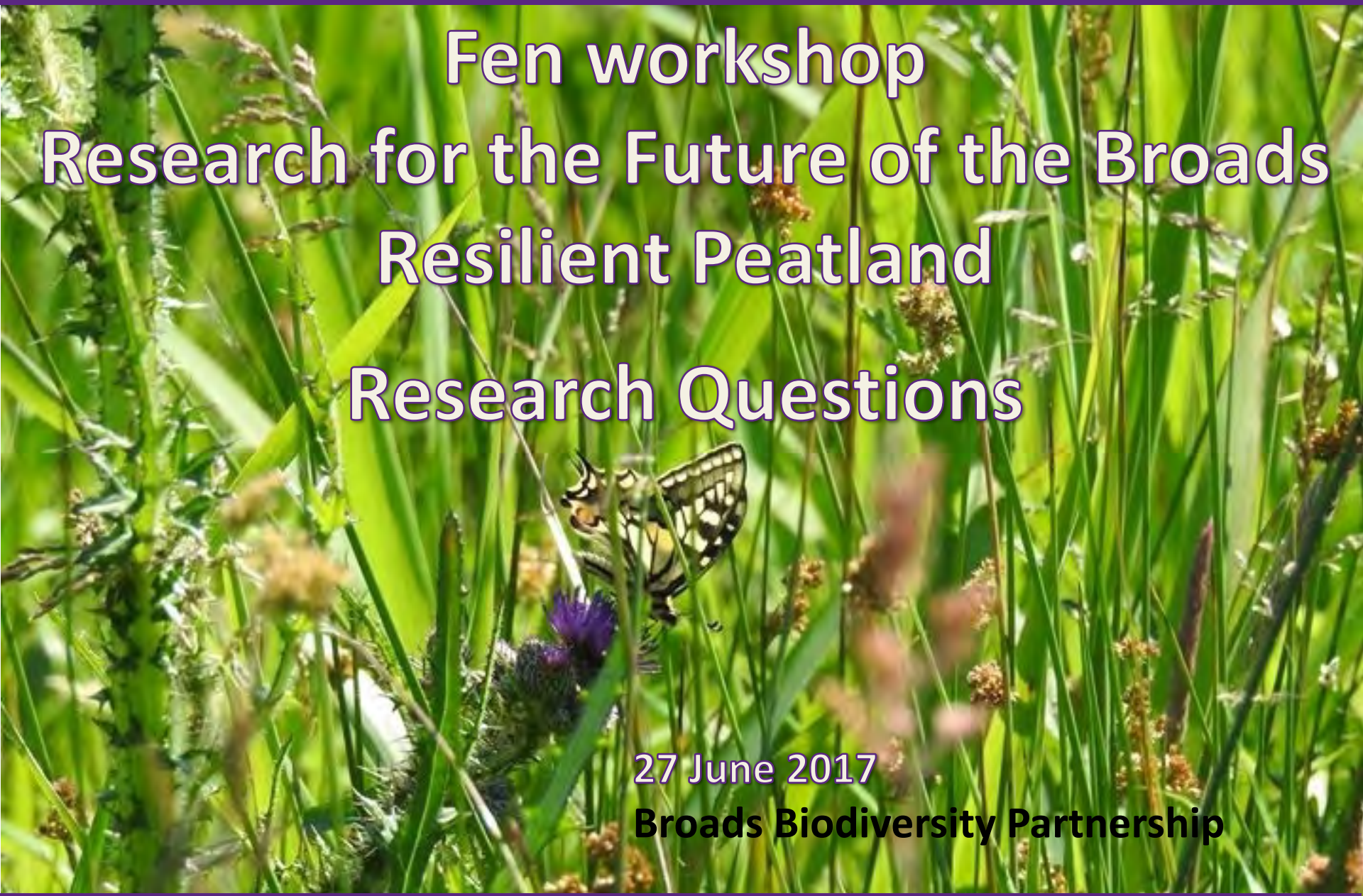
- **Why** – done ☺
- **What** – your task to prioritise the research questions and add any that are missing

(The top 2 priority research questions)

- **How** – describe the mechanism
- **Who** – assigning actions where possible
- **When**

Types of actions

- **Working with universities and through Knowledge Exchange** to achieve better understanding of pressures on fen habitat and priority species
- **Developing specialised volunteers** to support survey and monitoring
- **Learning from existing research**
- **Public funding for essential surveys** to environmental change, inform management and habitat quality, including partners pooling their survey plans and so lessen costs and working in partnership
- **Species or habitat focused research** will remain interesting for funders, despite the narrative around resilience, natural function and large scale (‘Million Ponds’ project and ‘fen raft spider project’)
- **New investments** from private companies and developer contributions



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Research Questions

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The focus of the research questions

- Understand the environmental support systems and change adaptation response across the whole floodplain
- ‘Consider natural processes’
- Inform habitat management prescriptions/outcomes for peatland resilience
- ‘Consider species populations’

The exercise

- **What research evidence do we need?** (Think about what do we want to see happening, and how will the evidence help it to happen? Are there other things that could be done as well/instead to achieve the desired benefits?)
- **Prioritisation**: From that list, what is most important/urgent and why (what happens if we don't do it);
- **Opportunities**: how do we get what we need – action plan of who does what when, and next steps

Themes For Research

A. Natures benefits (economic and social) & Sustainable fen management (commercial cutting, biomass/soil improvers)
B. Re-creating fen for rare, complex, species-rich or distinctive biodiversity
C. Peatland functioning and response to long term change Water supply (acidification, drying)
D. Peatland functioning and response to long term change Water chemistry (enrichment, salinisation)
E. Succession management (grazing, cutting, digging)

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 store, water purification, flood prevention and biomass production what further research is required to assess these values?
2. What methods and tools can be developed to support advocacy of fens, their value to society and their requirement for conservation?
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.
4. How can a viable market for fen management arising's be secured?
5. Should CANAPE research the market for 'Conservation grade silage or hay' or has this work been done already?

B. Re-creating fen for 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)?
2. Can these key site characteristics be re-engineered once lost or degraded?
3. How can the re-assembly of species-rich or distinctive fen types be encouraged once environmental conditions have been stabilised?
4. Which management techniques are required to restore degraded fen types to species rich complex fen types?

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

Catch dykes and connectedness

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

Acidification

6. 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?
7. What are the key habitat characteristics which support poor-fen and transition mire in the Broads?
8. Which WetMecs (sensu Wheeler et al 2009) accommodate acid noda?
9. Is the frequency of acid noda increasing, and is the extent of existing locations increasing?
10. What are the floristic relationships between acid noda and their surrounding vegetation types? Are the floristics of particular acid 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?
11. What is the role of management in maintaining acid communities?
12. How should the potential conflict between expanding transition mire and declining rich-fen be resolved?
13. How can **oxygen** status be measured easily and thus be related to groundwater flows?

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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?
2. What are the nutrient and solute budgets of individual fens? Can individual plant communities be assigned nutrient budgets within larger fen complexes?
3. How do different fen communities respond to different levels of nutrients and salinity? Which species are particularly vulnerable?
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?
5. If a fully functioning, fully connected floodplain is restored, how can negative impacts of poor water quality best be mitigated within a site?
6. What management strategies can be deployed to mitigate harmful levels of nutrients or salinity?

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E. Succession management (grazing, cutting, digging)

Grazing

1. What is the nature of the relationship between grazing and fen habitat structure? 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? Are wildfowl significant vectors of plant propagules?

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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?

E. Succession management (grazing, cutting, digging)

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?

Fen Research Insights

1. Broadland fen supports UK's richest biodiversity
2. Elements of river water quality have improved
3. Clear evidence of negative change
4. Need better routine monitoring of vegetation change needed
5. The only long term data collection is hydrology monitoring & river water quality
6. Limitations of data in the microenvironment of wetlands
7. More strategic approach to collection of new long term data
8. There appears to be less research in the fens compared to lakes
9. Fen grazing and the effect on substrate and community is not well understood
10. Adaptation, natural function needs consideration