

Report

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Integrating Fund Project Review. 21st November 2000

The Environmental Characteristics of Urban Environments

Overview of Objectives and key Achievements

This project, which commenced in November 1996, was different from most IF projects in that it had strategic as well as immediate scientific goals.

The **strategic objectives** of the project were twofold:

- to provide an injection of science budget funding into the new area of urban environmental research within CEH to coincide with the launch of the NERC URGENT thematic programme;
- to bring together members of staff in the former CEH institutes who had not worked together previously and most of whom had not worked on urban environmental issues.

The **scientific objective** was to determine the effects of urbanisation on patterns of distribution and abundance of terrestrial and aquatic flora and fauna.

Given the lack of a history of urban research in CEH and the newness of the collaboration we were aware from the start that it would be difficult to produce a fully integrated project, and this has proved to be the case. However, considerable attempts have been made to collaborate where possible, most success having been achieved in the (Monks Wood/Dorset) work on the River Cam in Cambridge which has led to the production of one scientific paper. The amount of effort which it was possible to devote to the project as a whole was influenced by the successful applications to URGENT by Monks Wood and Dorset staff, by the loss of a key member of staff (Brian Eversham) at Monks Wood at a critical time, and by the difficulty in obtaining essential database information for the 2nd and 3rd year hydrological component of the study. Bearing these constraints in mind the key achievements of the project are:

a. Scientific achievements

1. It has been clearly demonstrated that while increasing urban land cover is not associated with increasing terrestrial plant species diversity it is associated with increasing proportion of non-native species. Complete urbanisation approximately doubles the proportion of non-native species, and the proportion of exotics is twice as high in southern Britain as in the north;
2. Contrary to the expectations of some researchers in this field, enhanced dispersal by man is shown not to be the main factor in maintaining the urban flora; availability of urban habitats and high levels of disturbance are more important;
3. The majority of native plant species are likely to persist in newly urbanised areas provided existing woodland is preserved;
4. Evaluation of ecological indicator values of British plant species suggests that Ellenberg values based on continental European data can be extended to Britain. This is likely to be particularly useful when interpreting the significance of recombinant species combinations containing significant proportions of non-native (chiefly continental European) species in urban areas.

5. A clear link has been demonstrated between loss of aquatic macrophyte species from the River Cam over the past 150 years and their trophic requirements; species of less eutrophic habitats have suffered disproportionately from urbanisation;
6. Reduced sewage discharges into the River Cam were not accompanied by increased diversity of aquatic macrophytes. It seems that the maintenance of aquatic macrophyte diversity requires more detailed attention to the conservation or restoration of habitat features;
7. The Cam work suggests that the interpretation of botanical records in terms of recorded management history is likely to throw light on the impacts of urbanisation wherever sufficiently detailed botanical records exist;
8. A full characterisation of urban rivers has been completed using the Environment Agency's River Habitat Survey data. This has shown that:
 - Modification of the river, including resectioning and reinforcement of the channel and of the banks is more common in urban than in rural sections;
 - More artificial and fewer bedrock and boulder substrates are recorded in urban than rural river channels;
 - Because urban sections of river are generally at lower elevations than rural sections the urban sections are generally wider and deeper and have more uniform flow types;
 - Perhaps surprisingly, bankside trees occur slightly more frequently on urban than rural sections of rivers, although continuously tree-lined banks are less common.
 - There is little difference in the proportions of different channel vegetation types recorded at urban and rural sites, although filamentous algae (pollution tolerant) are more often recorded as extensive in urban areas and mosses (pollution sensitive) are less frequently recorded.
9. Comparisons of freshwater macroinvertebrates in three different types of urban towns (resorts, industrial, suburbs) have revealed surprisingly little difference between them. The fauna of the river is much more strongly influenced by the upstream nature of the catchment.

Conclusions and Forward Look

This 'pump priming' project has produced some excellent science which has thrown new light on the influence of urbanisation on the distribution and abundance of flora and fauna. Much of the work has been taken forward through four successful URGENT bids and CEH in collaboration with its HEI partners is now a key player in this area of environmental research. The development of more integrated studies across CEH has been limited to a considerable extent by the lack of compatible datasets for aquatic and terrestrial flora and fauna. This could only be remedied by inter-disciplinary studies at particular sites with sufficient funding to allow for the collection of new data. For example, in order to manage urban riverine habitats effectively for biodiversity it is important to know the impact of bankside land use and historical and current sources of pollution on the flora and fauna not only of the river, as is being done in URGENT projects involving CEH, but also of the adjacent terrestrial habitats. CEH staff are well placed to carry out such integrated studies.

Another interesting and more innovative area of research which is ripe for development is the characterisation of people's perceptions of urban environmental quality and identification of the patterns and processes underpinning the creation/maintenance of what they consider to be 'desirable'. Also, how valuable are those ecosystems in

measurable environmental terms – is what people like good for biodiversity, remediation of pollution etc.? If not can people be educated to accept more eco-friendly environments? How may key ecosystem processes be modified to produce the desired results? Addressing these and similar questions requiring a social science input is likely to be of key importance in making CEH urban research even more relevant to key players in the user community.

Projects outputs

Refereed publications

Roy, D.B., Hill, M.O. and Rothery, P. (1999). Effects of urban land cover on the local species pool in Britain. *Ecography*, **22**, 507-515.

Roy, D.B., Hill, M.O., Rothery, P. & Bunce, R.G.H. (2000). Ecological indicator values of British species: an application of Gaussian logistic regression. *Ann. Bot. Fennici*, **37**, 219-226.

Preston, C.D., Sheail, J. Armitage, P. & Davy-Bowker, J. (submitted). The urban impact on aquatic plants: Cambridge and the River Cam (25pp.).

Reports

Armitage, P.D., Symes, K.L. and Lowans, L. (1997). *Environmental characterisation of urban freshwater sites in Great Britain (Environmental characteristics of urban environments: first year report)*. CEH (IFE) internal report.

Good, J.E.G., Hill, M.O., Roy, D.B., Eversham, B., Armitage, P.D., Packman, J. (1997). *Environmental characterisation of urban environments: first year report*. CEH internal report, 12 pp.

URGENT bids

Nine bids to URGENT rounds one and two in this science area resulted in four successful projects, two involving Monks Wood staff and two involving Dorset (former IFE) staff.