London River Restoration: Establishing Ecological Resilience and Community Benefit.

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The UK Climate Impact Programme (UKCIP) scenarios indicate that the UK will experience higher temperatures, wetter winters, drier summers and more frequent and intense drought and flood events. This will modify riverine communities and alter how rivers perform a range of environmental services. Within London rivers form part of a natural infrastructure, providing essential services such as the provision of drinking water, flood risk management services and the provision of a green network for wildlife and people. For London to be an exemplar of sustainable development, measures are being developed to ensure that this change is managed to ensure that those essential services are protected and improved.

Palaeological evidence demonstrates that climate is the major factor controlling the global patterns of vegetation structure, productivity and plant and animal distribution. At a regional scale, changes in mean, and climate variability interacts with other human pressures, such as abstraction or and diffuse pollution potentially resulting in species and habitat loss. Water temperature, depth, velocity and flow are critical in determining riverine species distribution and the physical character rivers.

High velocities are required to move silts to enable fish to spawn on gravels, while localised scour is required to provide a source of gravel and create habitats such has pools and cliffs. Extended periods of lower velocities will result in gravel areas becoming increasingly silty, and as a consequence being of lower habitat value. Species distribution will change in response to temperature and flow. For instance in low flows the distribution of flow loving species will migrate downstream to more suitable habitat. This will result in a change of community composition. In some instances the community change may be such that it may result in a complete breakdown and reassembly of communities.

The ability of species to re-adjust distribution is dependant on the availability of adjacent suitable habitat and the removal of blockages to migration. To aid adaptation to climate change restoration objectives include the restoration of processes to enable physical readjustment and the removal of blockages to species movement.

The retention of suitable habitat can occur through the automatic adjustment of channel dimensions. Flows determine the extent of silt and vegetation within a channel. Where erosion, deposition and vegetation colonisation takes place, channel form will adjust to flow maintaining the diversity though not the extent of flow and habitat type, until a threshold is reached where features are lost. In concrete channels sediment transport and erosion is restricted so the physical adjustment of the river to flows is inhibited, therefore the threshold where loss of channel velocity and depth variation occurs is more frequent.

Long lengths of shallow water inhibit the potential for species to move both upstream and downstream due to the physical difficulties in moving across shallow water and increased likelihood of predation. The minimum depth required to enable course fish to move through a 20m section of channel is 10 cm. During low flows many concrete channels fall below this threshold making them impassable. A typical example is the Ravensbourne where in 1999 63% of the channel was either culverted or in concrete channel. During normal low flows at Chinbrook meadows, the depth of water in the relic concrete channel was a uniform 5cm while in the restored section the depth varied from 1 to 40 cm. This depth variation was due to pools being created as part of the restoration.

Extreme events such as flood, can have severe impacts sensitive populations. Given time, systems can recover, as demonstrated by improvements in the Thames. If the frequency or intensity of these events increase then the losses resulting from each event outstrips the ability of the system to recover, resulting in extinction. Species at particular risk are those where other pressures such as water quality or poor habitat compound the impacts and inhibit recolonisation. River restoration objectives to develop resilience include increasing community diversity, improving survivability and aiding recolonisation.

River restoration improves physical/habitat diversity resulting in improved species diversity. At Chinbrook meadows the concrete channel contained 9 invertebrate taxa in 2001, while three years after the restoration 39 taxa were found. There has also been substantial increased in the bird and fish diversity partly as a consequence of this increase, with kingfisher, minnow and stickleback now found on site.

During flood events the dissipation of stream energy across the flood plain reduces the likelihood of biological washout, while habitat features such as vegetation, backwaters, and gravels act as refugia, enabling species to shelter from higher flows.

Mechanisms for recolonisation include downstream and upstream drift aerial colonisation, and the redistribution of surviving populations. The proximity of refugia, including micro habitats act as the primary sources of re-colonisation, significantly speeding the process. Where habitat is restricted or has been lost, then the recolonisation process is further retarded. With increased frequency of events the lack of refugia within a system may lead to the extinction of species as a consequence of extreme events. Improving habitat quality improves survivability of an event and improves the rate of recolonisation. Where rivers have been restored, natural recolonisation is rapid, for instance within two years of the deculverting of Sutcliffe Park in LB Greenwich, kingfisher, little egret and little grebe were recorded.

Community participation is an essential component in urban river restoration. For this to happen experience in London has shown that a scheme must also deliver immediate community benefits. Studies on two sites (see box 1) have shown that restoration amongst other benefits has increased visitor numbers and reduced anti social behaviour. The significance of the findings for London is the evidence that increasing frequency of flooding in public open space is not incompatible with amenity value.

Existing restoration schemes have demonstrated how on a river reach basis ecological resilience and adaptation has been improved during the present drought event. These schemes have also provide benefits for flood risk management and have increased the amenity value of the sites, demonstrating that schemes can address long-term issues while providing immediate benefits to communities. To respond to the longer term impacts of climate change, individual sites need to be joined to form a cohesive network of multi-benefit open space for wildlife and people. The development of such a network is dependant on spatial planning recognising the importance of such networks such as the Greater London' Authority London Plan 'Blue Ribbon Annexe', and the integration of sectors including private developers to achieve multiple benefits. In London the green grid is being developed with the goal to deliver a network of multi-benefit open space.

Current policies within the London Plan include:

Policy 4C.2 Context for sustainable growth.
Development and use of the water and waterside land along the Blue Ribbon Network should respect resource considerations and natural forces in order to ensure future development and uses are sustainable and safe.

Policy 4C.3 The natural value of the Blue Ribbon Network.
The Mayor will and the boroughs should, protect and enhance the biodiversity of the blue ribbon network by:

- resisting development that results in a net loss of biodiversity.
- designing new waterside developments in ways that increase habitat value, taking opportunities to open culverts and naturalise river channels.

Policy 4C.4 Natural landscape.
The Mayor will, and the boroughs should, recognise the Blue Ribbon Network as contributing to the open space network of London. Where appropriate natural landscapes should be protected and enhanced. As part of Open Space Strategies, boroughs should identify potential opportunities alongside waterways for the creation and enhancement of open spaces.

Policy 4C.5 Impounding of rivers.
The Mayor will, and the boroughs should, resist proposals for the impounding or partial impounding of any rivers unless they are clearly in the wider interest of London. Proposals that include the removal of such impounding structures should generally be welcomed.

Annexe 5 of the London Plan sets out a series of strategic actions for the Mayor to undertake in partnership with others, in pursuance of the Blue Ribbon Network principles and policies. Action5 states:
The Mayor will work with others and particularly the Environment Agency to establish a restoration strategy for the tributary network.

Future policy initiatives include the Greater London Authority climate change strategy and a green grid planning framework to be published in the autumn of 2006.To achieve river restoration through development practical guidance is required and a

case to illustrate benefits made. Discussions are underway to develop an urban river restoration demonstration site as part of the Olympic legacy and undertake further research especially in the fields human health and river restoration.

Text Box 1. Case Studies.

Chinbrook Meadows

Scheme Details:

- 400m concrete channel restored.
- Restore flooding to historic meadow.
- Educational facilities.
- Wetlands and ponds
- Sporting facilities.

Benefits.

- Increased biodiversity.
- Reduced flood risk
- Re-establish natural processes
- Increased environmental awareness
- Community involvement and participation.

Sutcliffe Park.

- Scheme Details:
- Deculvert 500m of river.
- Provide storage to protect 600 homes.
- Creation of wetlands.
- Educational facilities.
- Footpaths and cycleways.

Benefits:

- Number of visitors to park increased by 73%.
- Visit increase from 34 to 47 minutes.
- Total time spent in park per month increased by 3 hours.
- 28% of visitors only visited scheme since completion of project