

Under the Radar: Combining animal habitat enhancement with creative landscape design in the formation of new urban places

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Native animal habitat enhancement offers opportunities for the design of new urban landscapes. A project in Auckland, New Zealand, called Under the Radar, exemplifies this relatively new area of urban landscape architecture. Under the Radar highlights the unique volcanic landscapes of the Auckland region by focusing on the ecology of the native lizard populations whose habitat is the volcanic field on which the city is built. It seeks to draw attention to the web of biotic and geologic relationships which lies just under the radar of Aucklanders, and which provides the special character of the landscape that they interact with on a daily basis. At the same time as bringing the cryptic lives of skinks and geckos to the attention of the people who live among them, the project contributes to the scientific understanding of lizards. It intersects scientific data about lizard species with place-specific socio-cultural data to generate landscape form.ⁱ

Under the Radar uses the GIS programme ArcMap to discover specific locations for design interventions. Maps of particular data sets are superimposed, and where the richest interaction between sets occurs, a lizard 'intensity' is identified. The site's geologic and vegetative structure and its cultural/social conditions are then analysed. Design operations extrapolated from the specific conditions of each site are used to develop 'interventions.' The data sets are:

- Lizard populations (because there are no maps of these, a vegetation surrogate is used).
- Volcanic rocks (of which there are several types).
- Cycleways and walkways (a network stretches across the Auckland region).

The interventions are 'lizard gardens,' enhanced lizard habitat structures that encourage, support and maintain lizard populations by providing the ecological niches, comprising volcanic rocks, leaf litter and plant species, that form lizard habitat. These new landscapes are attractive to humans too. They provide interestingly designed green areas (right in the middle of cities) where visitors can encounter and interact with beings that are often barely registered by the public at large. Intensities have been discovered at a number of locations. Those so far chosen for the project are at the Otuataua Stonefields on the shore of the Manukau Harbour in Mangere, and Tahaki Reserve on the slopes of Maungawhau volcanic cone in Mt Eden.

Under the Radar is a science / art collaboration. The project team consists of a lizard ecologist (or herpetologist), a plant ecologist, landscape architects, a public art specialist and a curator of projects.ⁱⁱ Herpetologists study reptiles; not only what they eat and what eats them, or the ingenious means by which they derive their body heat from the radiation of the sun, but how they exist within a geological and botanical environment that structures their patterns of existence. The ecologist observes, measures, classifies, and on the basis of this work draws hypotheses about lizard behaviour and habitat structures. He/she determines the lineaments of the lizard ecology, and describes the conditions that are necessary for reptilian life. An abstract ecological model is derived. It diagrams the links between the trajectories of reptiles and all the structures and flows with which they come into contact. The landscape architect uses landscape analysis and environmental mapping to cross-reference with the scientific data and then, through an extrapolation of operational procedures, generates formal modifications of the landscape.

Like all creatures lizards associate themselves with a particular combination of environmental conditions. In so doing they form part of a biotic community that includes plant, animal, insect and bird species as well as themselves. A biotic community is an assemblage of organisms living together and interacting. A lizard assemblage is a sub-unit of such a community. Biotic communities and their component assemblages are without rank and scale. A reptilian assemblage, for instance, could be as small as a dead log, or it could be the entire forest floor. It could even be the rainforest itself (Heatwole and Taylor 1987:185). Important aspects of assemblages are the numbers and kinds of species they contain, and how these structural characteristics change in space and time in relation to environmental conditions. Different lizard species can comprise an assemblage.

Once the habitat and microhabitats of particular species have been defined, it is possible to enhance the use of existing habitat structures by adding in special features, such as food sources and perching opportunities. Certain species prefer certain habitat structures. The greater the number of microhabitats the greater the number of species of lizard can be accommodated. The species that may be found in the project intensities share a requirement for similar structures: logs, rock outcrops, leaf litter.

Temperature is one of the most important single factors in the ecology of reptiles and a great portion of the daily activity of many species is devoted to corresponding with the thermal environment (Heatwole and Taylor 1987:21). In any natural environment, however, there is tremendous thermal diversity. On the one hand, a lizard will gain heat from some sources and lose it to others, and on the other heat gain and loss changes with the time of day. Heat exchange with the environment is critical. This occurs in the following ways:

- absorption of radiant energy

- radiative loss
- conduction
- convection
- evaporative cooling

In the morning lizards have low body temperature, and come out of their lairs to bask on twigs, branches and other similar structures. At this period they increase their temperature by the absorption of radiant solar energy. Absorption is maximized by their bringing only their feet into contact with the twigs to minimize heat loss through conduction. Sometimes they will perch on three legs. Later in the day when the substrate is warmer, the lizards will tend to occupy solid perches such as rocks which have themselves absorbed solar energy. On such rocks lizards will lie in full contact with the perch, absorbing heat both from the sun, and by conduction from the rock.

The design of lizard gardens, then, will rely on operations that maximize such aspects of the geometrical habitat configuration as:

- inclination of surfaces (in NZ north facing surfaces increase the thermal environment)
- presence of rock crevices (for protection and hibernation)
- substrate texture (provides food source and protection)
- perch height (for thermal absorption and protection)
- diameter and density of overhead canopy (maximise solar penetration to habitat)

OTUATAUA LIZARD GARDEN

The Otuataua Stonefields Historic Reserve is the only remaining Maori stonefield site in public ownership.ⁱⁱⁱ It was formed by the eruption of two volcanic cones, one of which has been extensively mined, while the other is relatively intact. Large quantities of volcanic stone from the eruptions were used both by Maori and Europeans in the making and protecting of gardens. Wall remnants clearly show the patterns of occupation and gardening from early Maori horticultural practices to latter day orcharding and farming. Maori garden wall alignments, primarily constructed in chevron patterns to maximize *kumara* exposure to the sun, have been overlaid by quadrangular walled enclosures specific to European farming practices.^{iv} The result is a singular array of structures that visibly record the history of settlement of this part of Tamaki Makaurau.

A number of different species of skink have been observed at, or may be considered as likely to inhabit, the stonefields site. These are the now endangered moko skink (*Oligosoma moco*), the copper skink (*Cyclodonia aena*), the ornate skink (*Cyclodonia ornata*) and the rainbow skink (an Australian native that

has been observed in stone walls at the entrance to the stonefields). The Otuataua lizard garden has been designed to fulfill the ecological requirements of these species – what they eat, the space they control, and their thermal requirements.

The location for the lizard garden is close to the stonefields reserve but not actually in it. The garden is proposed for a site where the coastal walkway turns ninety degrees and heads towards the boundary between the stonefields reserve and a coastal and foreshore restoration zone. This walkway is proposed to become part of Te Araroa (The Long Pathway), the walking trail running the length of New Zealand. At this point the walkway runs beside two large earth-covered stone mounds, and affords impressive views both of the stonefields and the Manukau Harbour.

The design proposes a series of dry rock forms and an earth mound oriented to the sun, creating heat panels which provide a localized climate ideal for thermal absorption, conduction and convection. The dry rock structures provide vertical perches and lateral crevices for basking and protection. Planting adds further to the habitat structure with the provision of twigs and branches for perching in the morning, and leaf and twig litter on the ground plane for protection and foraging for insects. Lines of flax (*Phormium tenax*) bound the garden and help provide the microclimate conditions lizards require.

As well as providing habitat the design of the garden extends the historic stone garden structures of the reserve to create a new terrain that intensifies and focuses the patterns of early gardening techniques. The pit and mound continue the topography of the stonefields, the stone structures reflect their geometries, and tamarix trees introduce the exoticism of the orchard.

The resulting garden provides a timely laboratory for the study of lizards. These reptiles are urban indicator species, and can tell us much about the biodiversity of our cities. But the body of knowledge of northern New Zealand herpetology is evolving only slowly, due to the diminished locations and range of the endemic lizard population. The Auckland region currently provides habitat for twelve species of lizard. Prior to urbanization there were eighteen. The depredations of prolonged urban development and the corresponding growth of predator populations have taken their toll. The lizard population of Auckland is therefore in a critical phase. The Under the Radar project shows how new animal habitat can be designed in urban situations to enhance at-risk species chances of survival and at the same time provide a new kind of public open space.

REFERENCES

Heatwole, H.F. and J. Taylor 1987 *Ecology of Reptiles*. Chipping Norton: Surrey Beatty

NOTES

ⁱ This research on urban animal habitat design for human places is in its early stages. In order to simplify objectives and exert some control over outcomes we have limited the design of habitat structure to a single species. It is planned that, once results are in for this work, multi-species habitat structures may be designed.

ⁱⁱ The Project Team is as follows:

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Dr Graham Ussher, Lizard Ecologist, Auckland Regional Council

Leslie Haines, Field Ecologist, Unitec New Zealand

Bradbury McKegg, Landscape Architects

Katrina Simon, Landscape Architect

Scott Greenhalgh, Landscape Architect

Paula Wilkinson, Landscape Architect

Gisella Carr, Director Finance, Te Papa Tongarewa The Museum of New Zealand

John McCormack, Starkwhite Gallery

ⁱⁱⁱ Maori are the indigenous people of New Zealand. They have been in continuous occupation of the country since at least the 14th century.

^{iv} *Kumara* (*Ipomaea batatas*) is the Maori name for several species of sweet potato, a tuberous food plant that early Maori settlers brought to New Zealand from Polynesia, the widely-distributed network of Pacific Islands from which they migrated. Growing *kumara* in New Zealand's cooler climate required the rapid development of new horticultural techniques, including devising ways – such as stone alignments – of prolonging exposure of the growing plants to the sun.

Illustration Caption: Otuataua Lizard Garden Concept Design and Perspective