indicators

The following indicators were derived from the discussions at Workshop 1 and previous indicator research undertaken by the Design Centre for Sustainability and its partner research groups.*

The proposed Biodiversity Indicators are:

Natural Area Proximity

Habitat Intensity

Tree Canopy Intensity

Natural Shoreline Intensity

Greenway Connectivity

Habitat Reservoir Distribution

Habitat Diversity

Ron Kellett, Sara Fryer & Isabel Budke. 2009 Specification of Indicators and Selection Methodology for a Potential Community Demonstration Project. Report for CMHC/NRCan.

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Natural Area Proximity

INDICATOR

Natural Area Proximity reveals the degree of connection between residents of Metro Vancouver and the natural environment. Ensuring natural areas are located within close proximity of residents creates opportunities for people to connect with nature, produces measured psychological benefits for residents, fosters a sense of stewardship, and provides recreation opportunities.

DESIGN METRICS

- % residents within 1 km of a 10 ha habitat patch supporting keystone species
- % residents within 500m of a green space

SUPPORTING STRATEGIES

- Increase direct contact with biodiversity
- Increase awareness of natural systems in the region through educational programs
- Increase awareness of endangered species in the region through educational programs
- Limit planting of invasive species in home gardens
- Promote planting of locally appropriate and native plant species
- Limit pollution of habitat areas
- Incorporate biodiversity conservation priorities into plans and policies
- Connect peoples backyards with the larger environment
- Recognize the role of cultural landscapes

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Habitat Intensity

INDICATOR

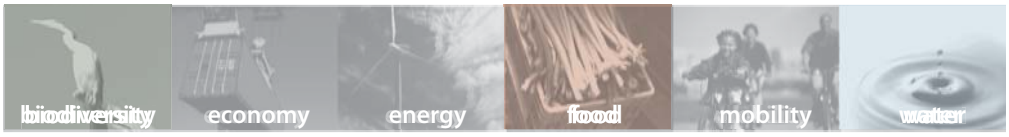
Habitat Intensity reveals the potential for the protection, restoration, and integration of natural functions and systems. Protecting, restoring, or creating natural habitat areas helps to maintain and enhance biodiversity and serves several ecological functions, such as regulating climate, filtering water, pollinating plants, and decomposing waste.

DESIGN METRICS

- % protected habitat area in the region
- no net loss of habitat
- % of park area protected for conservation purposes

SUPPORTING STRATEGIES

- Presence of Naturescape program within a community
- Promote stewardship of streams and other important habitat areas
- Promote invasive species removal
- Promote stewardship by property owners
- Promote farming techniques that increase biodiversity
- Limit soil removal
- Promote planting of locally appropriate and native plant species
- Protect threatened and endangered species
- Conduct inventories of environmentally sensitive areas
- Incorporate biodiversity conservation priorities into plans and policies
- Use tax incentives for private land protection
- Limit use of fertilizers and pesticides
- Use rooftops for habitat creation
- Recognize the role of cultural landscapes



Tree Canopy Intensity

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INDICATOR

Tree Canopy Intensity reveals the degree to which tree canopy coverage sufficiently supports ecological functions. Trees help to manage stormwater by absorbing rainfall and reducing surface run-off. They sequester carbon and improve urban air quality by absorbing carbon dioxide and producing oxygen. They also increase urban habitat and mitigate the "urban heat island" effect through cooling and shading. Diversity of species and age is an important consideration for tree canopy.

DESIGN METRICS

- % tree canopy coverage in all urban areas

SUPPORTING STRATEGIES

- Limit tree removal, particularly mature trees
- Limit recreation in sensitive habitats
- Connect peoples backyards with the larger environment

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Natural Shoreline Intensity

INDICATOR

Natural Shoreline Intensity reveals the potential for shorelines in the region to provide habitat and adapt to climate change. Natural shorelines mitigate the effects of sea level rise by allowing areas to flood during storms or flood events. Shorelines in the region have high biodiversity potential by providing critical habitat for a number of species.

DESIGN METRICS

- % natural shorelines
- % open stream channels

SUPPORTING STRATEGIES

- Promote stewardship of streams and other important habitat areas
- Promote invasive species removal
- Limit pollution of habitat areas
- Protect threatened and endangered species
- Connect biodiversity network with other functions, including mobility and water
- Promote soft edges along waterways to encourage riparian habitat

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Greenway Connectivity

INDICATOR

Greenway Connectivity reveals the potential for species movement throughout the region. Greenways are a key tool for connecting habitat patches and reservoirs throughout the region, especially in urban settings. This results in greater potential genetic diversity and species adaptation.

DESIGN METRICS

- % habitat patches connected to other patches or reservoirs with a viable greenway
- # greenway intersections
- # connections per patch
- % impervious surface
- Road density

SUPPORTING STRATEGIES

- Limit tree removal, particularly mature trees
- Limit pollution of habitat areas
- Incorporate biodiversity conservation priorities into plans and policies
- Use tax incentives for private land protection
- Connect biodiversity network with other functions, including mobility and water

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Habitat Reservoir Distribution

INDICATOR

Habitat Reservoir Distribution reveals the amount of large habitat areas throughout the region. Protecting large habitat reservoirs is critical to maintaining high biodiversity throughout the region.

DESIGN METRICS

- # habitat reservoirs per municipality
- % reservoirs that are protected
- % total area of landscape remaining as habitat reservoirs

SUPPORTING STRATEGIES

- Increase awareness if endangered species in the region through educational programs
- Allow natural disturbance to occur
- Limit recreation in sensitive habitats
- Limit pollution of habitat areas
- Protect threatened and endangered species
- Increase information base about regional biodiversity at more detailed scales
- Conduct inventories of environmentally sensitive areas
- Monitor the status of biodiversity in the region

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Habitat Diversity

INDICATOR

Habitat Diversity reveals the number of different habitat types protected in the region. A diversity of habitat types protects biodiversity and ensures resiliency for climate change. When determining what types of habitat to protect, it is important to consider rare, representative, and connecting habitats, indicator ecosystems, climate change implications, and role of cultural landscapes in habitat protection.

DESIGN METRICS

- Simpson's diversity index of habitat types
- # habitat patches protected/habitat type
- % of habitat areas protected that are over 10 ha

SUPPORTING STRATEGIES

- Promote invasive species removal
- Promote stewardship by property owners
- Promote farming techniques that increase biodiversity
- Limit soil removal
- Limit tree removal, particularly mature trees
- Allow natural disturbance to occur
- Promote planting of locally appropriate and native plant species
- Increase information base about regional biodiversity at more detailed scales
- Conduct inventories of environmentally sensitive areas
- Monitor the status of biodiversity in the region
- Select keystone species to indicate habitat types
- Limit use of fertilizers and pesticides
- Use rooftops for habitat creation
- Recognize the role of cultural landscapes

summary notes

The following summary notes were synthesized from the notes recorded during Workshop 1. The summaries identify themes that assist in describing key issues and developing design-based indicators.

biodiversity

Biodiversity Discussion Summary – April 16, 2009

Data and mapping

Regional map

The current regional green zone map distorts the reality of habitat protection – the map looks very green, but much of the protected area is in the Coast mountains, which is primarily comprised of common uplands habitat. Less common lowlands habitat with high biodiversity value remains relatively unprotected in our region.

Data at the regional scale does not show the depth of information for biodiversity where it is experienced. For example, data on soil health is provided at a certain scale and can be indicative of biodiversity at that scale.

Patches, corridors, and the matrix.

The region hosts a wide range of habitat types, some more common that others. As noted above, uplands habitat, comprised of second growth forests, is relatively common throughout the province. The Metro Vancouver region includes rare habitat types, such as intertidal areas that are key habitat for migratory birds.

The team concluded that the protection of key species is an important strategy in the development of a healthy regional biodiversity network. Defining key species as indicators for biodiversity is not an easy task. Prior to stating the key species the team outlined key considerations for the development of a biodiversity network, later these considerations were outlined in a set of biodiversity metrics.

Disturbance

Disturbance is important for biodiversity. High biodiversity exists at the early serial stages of the forest. Renewal through disturbance implies greater biodiversity. Imagine a region with no more disturbances, consisting of middle and later serial stage forests, the consequences will be lack of biodiversity. Therefore, some places should be allowed to experience natural disturbance.

Habitat connectivity

Connecting protected habitat patches is a key goal. A connectivity strategy includes designated corridors for species dispersal. A sustainable region will have a regional biodiversity network and be supported by the restoration of private lands for the realization of this network. The biodiversity network will utilize other region-wide networks, such as the mobility network, and existing urban fabric to restore, enhance and connect patched habitats

Matrix

Our regional ecosystems are predominantly human-dominated. Supporting the existing green spaces and further introducing biodiversity in the "grey" zones will further enhance natural systems and connectivity between them. Urban biodiversity is an important goal: the grey disappears.

biodiversity

Indicator 1

Quality of information base for environmental planning (existing info is limited -ie. Forest cover)

Indicator 2

Grey becomes green both on the ground and above ground

Indicator 3

Private land issue – area of private land in covenants or other protection as habitat

Indicator 4

Amount of habitat where ecological processes (disturbance) can function (protected areas where recreation is lower priority).

Indicator 5

Integration with other themes

Water

- Constructed wetlands for water filtration
- Forest for hydrological function

Mobility

- Greenways for mobility (water, plants, wildlife, people).

Food

- Food production with high biodiversity

Indicator 6

- Network
- Heal disconnect between ocean and land

Indicator 7

Psychological benefits

- Emphasize experiential quality (implications of biodiversity)
- Connect people's backyards with the larger environment
- Neighbourhood access to environmental areas

Indicator 8

- 65% tree canopy cover (Diversity, Age, Noise)

Indicator 9

- Include habitat refuges and reservoirs

Indicator 10

All residents within 1 km of a 10 hectare habitat for keystone species

workshop 1 notes

The following un-edited notes were recorded during the Research Roundtable Workshop 1 group discussions.

Sustainability by Design Research Roundtable
Biodiversity Notes(formerly natural habitat)
April 16, 2009.

Participants:

1. Val Schaefer - Faculty Coordinator, Restoration of Natural Systems Program, University of Victoria.
2. Patrick Mooney – Professor, School of Architecture and Landscape Architecture, University of British Columbia
3. Sara Fryer – Researcher, Design Centre for Sustainability, University of British Columbia
4. Nick Page – Biologist, Raincoast Applied Ecology
5. Katherine Dunster – Principal, Unfolding Landscapes
6. Inna Olchovski - recorder

Discussion

Data and mapping

Regional map

The current regional green zone map distorts the reality of habitat protection – the map looks very green, but much of the protected area is in the Coast mountains, which is primarily comprised of common uplands habitat. Less common lowlands habitat with high biodiversity value remains relatively unprotected in our region.

The existing limits for growth at certain elevation levels, as in the British Properties example, are guided by utility provision constraints, such as water pressure. A limit at 500-700m maximum development could be applied as a baseline boundary for habitat mapping. This excludes the drinking watersheds, which are typically included in calculations of regional habitat, but represent a common ecosystem type in the province. If the drinking watersheds are excluded, the amount of natural habitat in the region is reduced substantially. The Baden-Powell trail could be a good boundary line.

- The regional map is deceiving, draw line at 500m elevation and base our metrics below this

Scale + Data

Is the existing data robust enough to drive policy development?

Data at the regional scale does not show the depth of information for biodiversity where it is experienced. For example, data on soil health is provided at a certain scale and can be indicative of biodiversity at that scale. The Axis map is not robust enough - it mapped forest cover without considering whether the cover was ornamental or functional. Consideration must be given to the specificity of maps and mapping tools. At the present time available data is limited.

- Mapping and data collection should be undertaken at a more detailed scale.
- Adopt the existing 1995 data from the First Orthophoto, Triathlon Data Set, as the source for baseline data.

Patches, corridors, and the matrix.

Habitat patches

Habitat types - What types of habitat are important?

The region hosts a wide range of habitat types, some more common that others. As noted above, uplands habitat, comprised of second growth forests, is relatively common throughout the province. The Metro Vancouver region includes rare habitat types, such as intertidal areas that are key habitat for migratory birds.

Issues raised:

1. Large areas throughout the region should be restored to a diversity of habitat types.
2. Important to consider (a) rare habitats, (b) representative habitats, (c) connecting habitats.
3. Use indicator ecosystems (ex. coniferous forests, wetlands, dunes etc.) to determine important habitat types.
4. In response to the habitat types outlined in the Provincial Biodiversity Conservation Strategy, the team concluded the eight out of the thirteen stated should be left in the discussion on biodiversity. These include wetlands, old forest, intertidal, freshwater, riparian, ocean, young forest, and old field. *The thirteen habitat types are listed in the research bulletin on Natural Habitat prepared by the DCS.*

Indicator species -What key species should be encouraged?

The team concluded that the protection of key species is an important strategy in the development of a healthy regional biodiversity network. Defining key species as indicators for biodiversity is not an easy task. Prior to stating the key species the team outlined key considerations for the development of a biodiversity network, later these considerations were outlined in a set of biodiversity metrics.

Issues raised:

1. Representative habitat types will be indicated by the presence of certain keystone species.
2. Consider the implications of climate change for the distribution of these species.
3. Selection of key species should also be interconnected with people's preference for certain species (ex. Hummingbirds, Woodducks), or the

significance of these species in the human environment. This point highlights the importance of connecting people to natural landscapes and their habitat, consequently, increasing quality of life, and building upon the experiential qualities of biodiversity.

4. Note forest types that will attract pollinators such as butterflies (ex. Big leaf maple and Prunus emarginata).

Disturbance

Disturbance is important for biodiversity. High biodiversity exists at the early serial stages of the forest. Renewal through disturbance implies greater biodiversity. Imagine a region with no more disturbances, consisting of middle and later serial stage forests, the consequences will be lack of biodiversity. Therefore, some places should be allowed to experience natural disturbance.

Issues raised:

1. Where in the region can these places exist and or be proposed? Where are the areas where disturbance can occur? As the Region continues to develop, existing areas can be used for natural disturbance (ex. Boundary Bay Regional Park – restore disturbance processes).

Outcome statement:

Everyone will live within a representative distance of habitat. The team concluded on a One (1) kilometer distance from a ten (10) hectare of habitat patch with the presence of keystone species.

Habitat connectivity

Connecting protected habitat patches is a key goal. A connectivity strategy includes designated corridors for species dispersal.

Issues raised:

1. North/South connectivity is missing in the region.
2. Connectivity implies the ‘gathering of lands,’ barriers include the existence of private land ownership. Would people be willing to dedicate portions of their properties through a tax incentives program? Opens a discussion on land acquisition, by-laws, long-term (100 years) environmental planning policy development for the creation of a biodiversity network. Some may argue that the money spent for the purchase of lands will be too high, a counter argument will be present day spending on transportation networks and the acquisition of private and public lands to fulfill these initiatives. Another option is the gathering of private and public lands to service varies other functions (mobility network), interconnected with the biodiversity network.
3. Important concern is the lack of attention, region-wide to coastal corridors. The team noted a disconnection between marine, shore, and inland systems.

Further consideration for the relationship between these systems will imply greater biodiversity opportunities. This is especially true of marine lands along the Vancouver shoreline, these lands lack in a distinct representative, responsible authority. These lands also offer large opportunities for restoration, although the team noted other constraints, such as cost and policy that may inhibit the restoration process. As a preliminary design strategy the team suggested the shifting of dikes towards the water, further away from the shorelines, and the potential restoration of biodiversity within the boundaries of the shore line and the dikes (this suggestion was made in reference to the southern most marine edges of the Region).

4. Overlapping networks – green, transportation, economy etc, beginning to shift biodiversity toward the urban neighbourhoods (ex. the Central valley Greenway, support variety of recreation and stormwater approaches).
5. How do we 'sell' biodiversity?

Outcome statement:
A sustainable region will have a regional biodiversity network and be supported by the restoration of private lands for the realization of this network. The biodiversity network will utilize other region-wide networks, such as the mobility network, and existing urban fabric to restore, enhance and connect patched habitats

Matrix

Our regional ecosystems are predominantly human-dominated. Supporting the existing green spaces and further introducing biodiversity in the "grey" zones will further enhance natural systems and connectivity between them. Urban biodiversity is an important goal.

Issues raised:

1. Ornamentation vs. functionality in landscape.
2. Explore the potential to mitigate habitat loss in large-scale developments by lifting the habitat to the roofs of large buildings. This is a potential strategy when development is inevitable, but we must be careful to avoid habitat damage when it is not necessary. Intact natural habitats are best left untouched; mitigation measures often result in a 30 – 50% loss of ecosystem function.
3. What role do cultural landscapes hold within the biodiversity network?
4. Certain types of farming will support high levels of biodiversity.
5. Ask for 65% canopy cover and low impact development requirements through the entire matrix.
6. A high biodiversity system will have a better metric for the urban back yard and urban trees (i.e. Queen Elizabeth Park transect from the park toward the surrounding neighbourhoods.
7. Trees should be properly located to encourage mutual benefits for biodiversity and for people.
8. Emphasis on the psychological benefits of biodiversity in the urban landscape (i.e. Eugene, Oregon, the benefits of large size street trees).

9. Regulate mowing, reduce use of fertilizers to encourage biodiversity, also related to reductions in energy usage.
10. Experiential implication of biodiversity, selecting key stone species that people can relate to or associate with their childhood memories (ex. frogs, bear, deer, douglas squirrel, and garden snakes.
11. Regional biodiversity maps indicate high biodiversity adjacent to waterways, but much of our waterways are fronted by industrial lands. The task at hand is to find a balance between industrial development and biodiversity along waterways.

Outcome statement:
The grey disappears.

Indicators:

Biodiversity Metrics

Baseline map – 1995, 1st ortho data set by triathlon → up to 500m development line, can't dilute with drinking water conservation areas.

Indicator 1

- Quality of information base for environmental planning (existing info is limited - ie. Forest cover)

Indicator 2

- Grey becomes green both on the ground and above ground

Indicator 3

- Private land issue – area of private land in covenants or other protection as habitat

Indicator 4

- Amount of habitat where ecological processes (disturbance) can function (protected areas where recreation is lower priority).

Indicator 5
Integration with other themes

Water

- Constructed wetlands for water filtration
- Forest for hydrological function

Mobility

- Greenways for mobility (water, plants, wildlife, people).

Food

- Food production with high biodiversity

Indicator 6

- Network
- Heal disconnect between ocean and land

Indicator 7

Psychological benefits

- Emphasize experiential quality (implications of biodiversity)
- Connect people's backyards with the larger environment
- Neighbourhood access to environmental areas

Indicator 8

- 65% tree canopy cover
    - Diversity
    - Age
    - Noise

Indicator 9

- All residents within 1 km of a 10 hectare habitat for keystone species
    - Coniferous forests
        - Douglas sauirpee woodpeckers
    - Young coniferous forests mixed
        - Trilliums
        - Chickadee
        - Hummingbird
        - Swanson's Thrush
    - Deciduous forests
        - Vireos
    - Wetlands
        - Amphibians
        - Dragon flies
        - Yellow Throat
        - Redwingedblack birds
    - Intertidal
        - Eel grass
        - Lyngby's sedge
        - Surf smelt
        - Heron
    - Riparian
        - Skunk cabbage
        - Coho cutthrodt
        - Dragonfly
    - Freshwater
        - Benthic invertebrates
    - Ocean
        - Sea duck

    - Harbour porpoise
    - Harbour seal
    - Crabs
    - Shrimp
    - Surf melt
- Old field
    - Northern Harrier
    - Barn Owl
    - Red-tailed hawk
    - Bittern
- General
    - Heron
    - Frogs (pacific tree, etc.)
    - Garter Snake

Indicator 10

- Include habitat refuges and reservoirs