7 / INSECT RESEARCH FACILITY

7.1 / THE IMPORTANCE OF POLLINATORS

Human labor simply cannot achieve the same outcome as the free service provided by ecosystems. Insect pollinators are a crucial part of human survival and as such need to be respected and maintained. The conservation of pollinators can be achieved through the protection of both their habitats and nutrition providers. We know very little about the potential of these insects and the services they can provide us. It is thus necessary to study them without destroying their existence or damaging their natural habitats. The information gathered must be made available to the public and interested stakeholders.

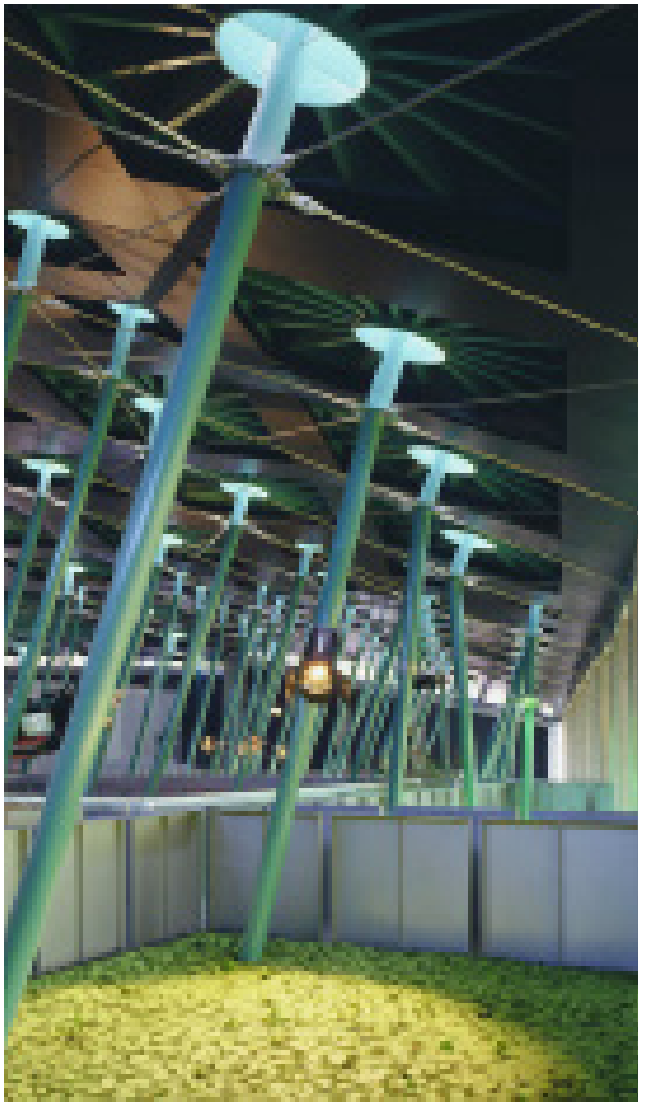
7.1_ Entrance to the museum (http://www.opus5.fr/ST-LEON-EN-LEVEZOU-Micropolis-Musee-des-insectes)

7.2 / CASE STUDY

MICROPOLIS; CITY OF INSECTS / A museum of the insect in the hills of Lévézou

Architect: Bruno Decaris
Area: 2 600m2
Location: Saint Léons in Levézou
Designation: An international center for insect research.

Micropolis superimposes the world of man, represented by an orthogonal path, on that of insect abundance, represented as slanted columns that form undergrowth. Visitors walk from the bowels of the hill to the light above, analogous to the insect in its metamorphoses.
The main building has a façade of mineral 500 m2 in size and a huge stained glass window that reproduces colour sequences in the visual perception of insects. The relevance of this project is as a link between human and insect. It is achieved through an architectural design that allows visitors to move from their human size to the size of insects; while the marked wall of soil strata rises, men's and insects' footprints change dimensions.



7.2_ Interior view of insect museum, columns used for roof is also light shelves (http://www.opus5.fr/ST-LEON-EN-LEVEZOU-Micropolis-Musee-des-insectes)

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The 15 exhibition rooms spread over 2400 m2 show the lives of insects in general. Some of the 15 explained topics include:

- Awakening to biodiversity
- The discovery of the five senses
- The breeding room
- The butterfly house
- Insects on the surface, in the soil, and in the water
- The social life of insects
- The menus of insects

7.3 _ Movement route of the Micropolis Insect City (http://www.micropolis-aveyron.com/fr/outils/documents/micropolis-plan-de-la-visite-2015.pdf)

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7.3 / THE PROGRAM

The insect research facility approaches insect rearing in a natural way by following the principles of regenerative design. The project under investigation is to house a research facility that broadens the study of entomology through the collection of helpful information to educate society on a regenerative and ecologically friendly future. The entomology research facility houses various programs: research, educational, recreational and habitats.

The supporting programs in the research facility strengthens the framework on which the facility supports on, and it is listed as follows:

1- Support buildings:
- Clerical staff offices
- Maintenance
- Utility rooms
- Workshops
- Warehouse
- Cafeteria
- Locker rooms
- Restrooms

2- Waste disposal:
- SOLID - Human waste
  - Processed solid waste
  - Organic waste material

3- Work-flow consideration:
Separation of irradiated and non-irradiated pupae:
- Separate entrance and exits required
- No staff movement between the two facilities.
- Radiation levels indicator
- Separate rooms with distinct temperature management.

4 - Management of sanitation when operating the facility: control of pest and contaminant organisms.
Treatment:
- Water-filled channels
- Vermin wire
- Depth of foundations
- Floor treatment
- Pre-building ground treatment.

5- Fire control, alarm system, and escape routes:
- Escape pathways
- Assembly areas
- Signage
- Placement of monitors
- Alarms
- Obedience to fire regulations

6- Record keeping:
Systems need to be employed for:
- Collection
- Storage
- Analysis of records.
- Backups of records should be stored in alternative locations.

7- Waste water treatment plant:
The options for use of waste water is either to discard or re-use. The re-use of waste water may require extra treatment. The degree of waste water treatment is dependent on the intended use of treated water.

8- Biosecurity areas for contamination control
Provision of showers, foot baths, changing rooms, airlocks, etc. The facility should be designed to maintain security that prevents insect escape; air locks, air curtains, and air tight doors are used.

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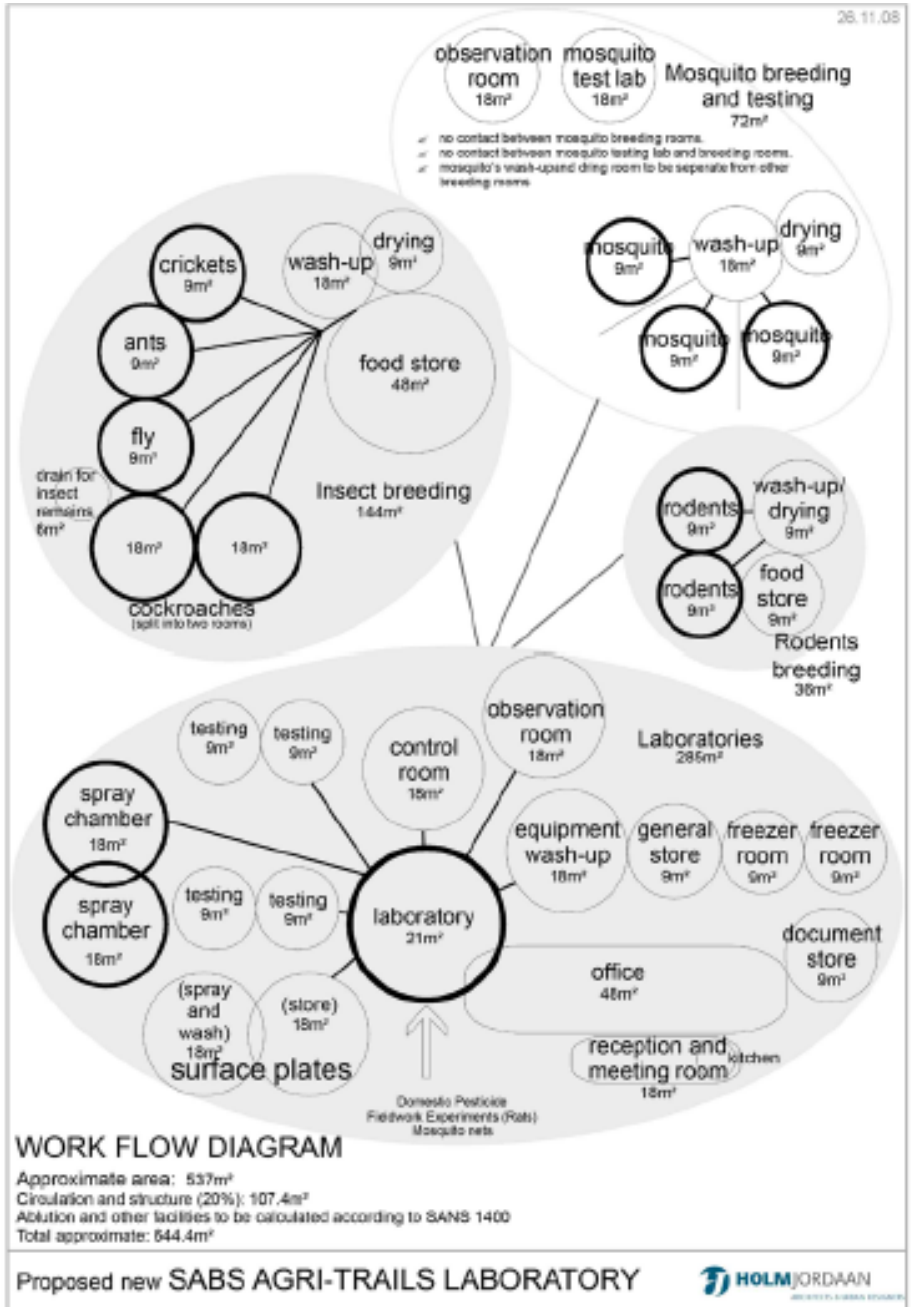

7.4 _ A typical work flow diagram for a insect research facility (courtesy of Holm Jordaan Architects).

7.3.1
RESEARCH / Administration building, offices, laboratories, Insect habitats

The research facility is to consist of three separate buildings. Two of these buildings are laboratories and one is the administrative building. Each laboratory holds different classes of insect pollinators, thus preventing cross-contamination. The laboratories are formed by a series of lobbies and self-closing sealing doors; to prevent the escape of insects. Every laboratory is a sterile environment that is treated differently than the rest of the building. The administration block is the control point where people enter the research facility.

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7.6 _ A Display panel with viewing wholes inviting the visitors to peak inside and experience insect habitats (Nel, 2015)

7.7 _ Display panels with insect information(Nel, 2015).

7.8 _ A visitor viewing the information in one of the display boards (Nel, 2015)

7.3.2
EDUCATIONAL / Entomology collection center, library, lecture rooms and exhibition spaces.

Information on the insects and their ecosystems is collected and showcased in the entomology collection center, which is an extension of the zoo. The information is to be revealed with the use of a gallery, exhibition space, lecture rooms and a library. As it is critical for the next generation to fully understand the importance of safeguarding the remainder of our planet's resources, this program facilitates school programs with organized field trips and lectures. Future generations must be made aware that it is necessary not only to restore ecosystems but also to enable the planet's resources to self-generate. This can be achieved by educating people on the characteristics of nature and the benefits it holds for society. The library and entomology collection, as well as a living wall and waste treatment facility, therefore play an important role in educating the people who visit the building. From figure 7.6 - 7.8 illustrates an interactive exhibition displaying the life of insects. This exhibition is held in the UK Nottingham Pavilion at the 2015 Milan Expo located in Italy.

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7.3.3
RECREATIONAL / Public and workers, production, social condition

The facility is designed for a fully beneficial partnership between humans and nature. Nature should be respected and guarded in all aspects of our lives; it is also truly valuable for our livelihood to combine the human experience with nature. The building allows visitors to experience different habitats and the benefits they provide. It also holds social value for the people of Pretoria by providing green spaces, walkways, gathering places, sun shades and seating. The products produced on site can be sold at the taxi rank on Bloed Street; where a new informal social node can develop. The water on the site is of benefit to the production of plants and agriculture, which form the main habitat and nutrition required by the insects. As a regenerative facility it also requires multi-functional programs to produce zero waste.

The economic value, generated through the production of fruit and plants, benefits the social condition. Although the production is on a small scale, as this is not a production facility, it is advantageous to the closed-loop-cycle of the regenerative theory. The facility produces the following:

1. Indigenous plants and flowers: the facility houses a variety of flowers and plants for the pollinators. The plants that play an important role in luring pollinators act as a nursery, creating potential economic value. List of the flowers grown and their descriptions:
2. Fruit and other foods that require pollination from insects: these are also cultivated and can be sold in shops in the city. This benefits shop owners in the city for there will be no need for long-distance deliveries.
3. Organic waste produced in the laboratory: the waste that has not been irradiated can be mixed with grass to produce feed for the zoo animals.
4. Insects: the insects can also be used for culinary purposes.
5. Clean potable water: the facility also focuses on producing clean potable water.

7.3.4
INSECT HABITATS / insects relationship with the environment.

Creating a habitat for the insects is one of the critical aspects of this research facility. The biological parameters need a thorough investigation to provide the insects with enough shelter and nutrition to attract the right kind of insects. The following table indicates the specific indigenous plant and flower types that attracts pollinator insects:

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Insect attractive indigenous plants	Size in mm	Insect order				Sun			water			Annual											
		Hymenoptera (Bees)	Lepidoptera (Butterflies)	Diptera (Flies)	Coleoptera (Beetles)	full sun	half sun	no sun	Lots	moderate	Little	summer		Autumn			Winter			Spring			summer
												Jan	Feb	Mrt	Apr	May	June	July	Aug	Sept	Okt	Nov	Des
Small Shrubs																							
Forest Spurflower (Plectranthus Fruiticosu	1000 x 1000		o				o	o		o		o	o										o
Bush Violet (Barleria obtusa)	750 x 10		o			o	o			o				o	o								
Yellow Seed (Eriosema psoraleoides)	20 x 750		o			o				o		o	o	o	o	o					o	o	o
Sun Hibiscus (Hibiscus calyphyllus)	1500 x 1500		o			o				o		o	o	o	o								
Rose-scented Pelargonium (Pelargonium	1300 x 1000	o	o	o	o		o			o		o							o	o	o	o	o
Geelblombos (Phymaspermum acerosum	1000 x 1000	o	o	o	o		o			o		o	o	o	o	o	o	o	o	o	o	o	o
Medium Shrubs																							
Velvet Brandybush (Grewia Flava)	2500 x 2500		o			o				o		o	o	o							o	o	o
Small-leaved plane (Ochna Serrulata)	2500 x 2500		o			o				o										o	o		
Christmas Bride's bush (Pavetta gardeniif	3000 x 2000	o	o	o	o	o	o			o		o										o	o
Cape Leadwort (Plumbago Auriculata)	3000-5000 x 3000		o			o				o		o	o										o
Purple Broom (Polygala virgata)	2000 x 1000	o				o				o								o	o	o			
Jelly Beans (Senecio Barbertonicus)	1500 x 1500	o	o		o	o					o		o	o	o								
Large Shrubs																							
False Olive (Buddleja Saligna)	4000 x 3000	o	o		o	o				o		o	o	o	o						o	o	o
Sagewood (Buddleja salviifolia)	5000 x 4000	o	o	o	o	o				o									o	o			
Cat's whiskers (Clerodendrum Glabrum)	5000 x 6000	o	o		o	o				o		o								o	o	o	o
Bluebush (Diospyros Lycioides)	4000 x 4000	o				o				o										o	o	o	o
Puzzle Bush (Ehretia rigida)	4000 x 4000	o	o	o	o	o				o										o	o	o	
Crossberry (Grewia occidentalis)	5000 x 3000		o			o				o		o	o									o	o
Silver Sugerbush (Protea roupelliae)	5000 x 4000		o			o				o			o	o	o								
Dogwood (Rhamnus prinoides)	4000 x 4000	o				o				o											o	o	o
*Champhor Bush (Tarchonanthus Camph	5000 x 5000	o	o	o	o	o				o					o	o	o						
Groundcovers and bulbs																							
Veld Aloe (Aloe greatheadii var. davyana)	200 x 400	o	o	o	o	o					o						o	o					
Pig's ear (Cotyledon orbiculata)	300 x 450		o			o					o								o	o			
Baberton Daisy (Gerbera jamesonii)	400 x 300	o	o	o	o	o				o										o	o	o	
Scented Grass Bulbine (Bulbine capitata)	450 x 350	o	o	o	o	o				o									o	o	o	o	
Stalked Bulbine (Bulbine frutescenes)	300 x 400	o	o	o	o	o					o	o	o	o	o	o	o			o	o	o	o
Pineapple Flower (Eucomis autumnails)	500 x 500	o	o	o	o	o	o			o		o	o										o
Trailing Gazania (Gazania rigens)	200 x 400	o			o	o				o		o	o							o	o	o	o
Star Flower (Hypoxis hemerocallidea)	400 x 500	o	o	o	o	o				o		o								o	o	o	o
Dwarf Agapanthus (Agapanthus africanus	350 x 350	o	o	o	o	o	o			o		o	o	o									o
Water Garden																							
Orange river Lilly (Crinum bulbispermum)	400 x 950	o	o	o	o	o			o											o	o		
River Lily (Crinum Macowanii)	400 x 800	o	o	o	o	o				o		o	o									o	o
River Stars (Gomphostigma virgatum)	1500 x 1500	o	o	o	o	o			o			o	o	o								o	o
Blue water lily (Nymphaea nouchali)	100 x 800	o	o	o	o	o			o			o	o	o	o					o	o	o	o
Small Yellow water lily (Nymphoides thun	80 x 800	o	o	o	o	o			o			o	o	o	o	o					o	o	o
White Arum Lily (Zantedeschia aethiopica	950 x 500	o	o	o	o	o	o		o			o								o	o	o	o
Annuals																							
Wild foxglove (Ceratotheca triloba)	1200 x 400	o				o				o		o	o	o	o	o						o	o
Climbers																							
Traveller's Joy (Clematis brachiata)	4000 x 2000	o	o	o	o	o				o		o	o										o

* The root system is aggressive and this species can successfully be used to control soil erosion

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7.5 _ Table (Left) of indigenous plants to Gauteng area that attracts pollinator insects and displays requirements (Joffe, 2003 edited by author, 2015)

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