Botanic Garden Creation and Management: the feasibility and design of new British collections

[On-line Edition]

PhD Thesis

University of Reading
School of Plant Sciences
James Furse-Roberts
jfurseroberts@botanics.org.uk

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Abstract
Introduction
Chapter 1 - Overview of Botanic Gardens
Chapter 2 - Survey of British Botanical Collections
Chapter 3 - Case Studies of Selected Botanic Collections
Chapter 4 - Discussion of Botanic Collections Elements
Chapter 5 - Design & Interpretation
Chapter 6 - Eden Project Case Study
Chapter 7 - Market Research
Chapter 8 - Carymoor Case Study
Chapter 9 - Alternative Solutions
Chapter 10 - Conclusion
Bibliography
Appendix

8 Carymoor Case Study

This thesis arose from a project that originated with a partnership between the University of Reading and Carymoor Environment Trust (CET). The author's role in this project was to assess the feasibility of creating a botanical collection and provide designs of the layout. Primarily based on the author's experience of working on this project, this chapter reviews the process of decision-making that occurred and its implications. The chapter concludes by discussing how this particular project could be realised.

8.1 The Somerset Plant Collection

Almost since the initial founding of the CET, there has been a desire to create some form of plant collection. In July of 1999 Angus Davies presented an internal report entitled '*Some Preliminary Ideas for the Development of the Carymoor Environmental Centre Plant Species Collection*'. In this, he stated that, "Within the Carymoor environmental project, there is an area of 5ha set aside for a 'Plant Collection'. Although broad concepts pertaining to the collection have been suggested - due to more pressing issues - firm plans have not been drawn up for the structure and implementation of this aspect of the Centre." To progress this project the University of Reading was asked whether a PhD student could be found to do a thesis looking at the feasibility, structure and design of a plant collection at Carymoor, to be known as the Somerset Plant Collection (SPC). In May 2001, this position was filled.

Carymoor has entered into partnership with a variety of organisations. These organisations are given the use of plots of the land the CET manages for relevant long-term research work. With these projects the research organisation usually does the initial preparation of the site and then whatever periodic monitoring they require, while the CET takeover the maintenance of the plots to the partners specification. The Somerset Plant Collection differs slightly from these other projects in that, with these, the management of the site was done for the purpose of the research, which had been instigated by the researching body itself. With the SPC, the concept originated with the CET themselves, who outsourced the research of how best to implement the original concept to the University of Reading. Thus, the research was to look at how a plot could be developed, rather than actually using the development of the site as the source of the research data.

8.2 Site Description

The Carymoor Environmental Trust site is located at Dimmer, 4.8km (3-miles) from the centre of Castle Cary and 3.2km (2-miles) from Castle Cary railway station, which is on the main line to London. Junction 24 of the M5 is 19-miles away and Bristol is 35.4km (22-miles).

Access to the site is not easy if not travelling by car. There are no bus routes that stop within walking distance of the site, and although it is located 3.2km (2-miles) from a direct train line into London travelling the last 3.2km (2-miles) would be tricky. In order to reach the CET site the visitor must pass by a scrap heap, the municipal rubbish disposal site and the weighbridge for the landfill site. As the landfill site is still active, the access road is shared with trucks carrying rubbish. These elements are part of the reason why the CET is located here and are a valuable part of the story of resource-use and sustainability, which school visits are taught. However, if the SPC were to be marketed as a visitor attraction this aesthetically displeasing approach could detract from the garden and would cause logistical problems with getting visitors on-site. This would be further exacerbated by the fact that at present the CET site barely has enough parking spaces to accommodate staff and two coaches. There

is also very little space in which to expand parking areas. In the past, when the Trust has held its open days, they have been reliant on Wyvern Waste, the operators of the neighbouring landfill site, allowing them to use their staff car park and/or using one of the plots of land earmarked for the SPC. This is not a long-term solution to this problem.

The case studies of existing botanic gardens, given in chapter 2, in particular those of the University of Bristol Botanic Garden (page 116) and the Royal Botanic Garden in Edinburgh (page 90), illustrate that, if possible, a location should be picked that will not inhibit the growth of the garden at a latter date. Figure 8.1 is a map of the land managed by CET showing how the site has been subdivided into several plots. The majority of these, plots 15-28, are capped landfill, i.e. they consist of 1-2m of blue clay over several metres of compressed domestic waste of varying ages. Of these, plots 16, 3 and M have been considered for accommodating the SPC. Of these, site 16 offers some future expansion on three sides; without the purchase of additional land, but only if the surrounding projects become redundant. Plot M is surrounded on three sides by agricultural land, which would be good for expansion but would require the land to be purchased. Plot 3 cannot be extended on two of its sides, the neighbouring plot, plot 4, is destined to be the site of the arboretum and therefore would also probably not be available. The remaining side borders agricultural land that could be used but would require purchase. Carymoor settled on plot three and, after some changes, the area bound by the green line in Figure 8.1 was designated for the SPC.

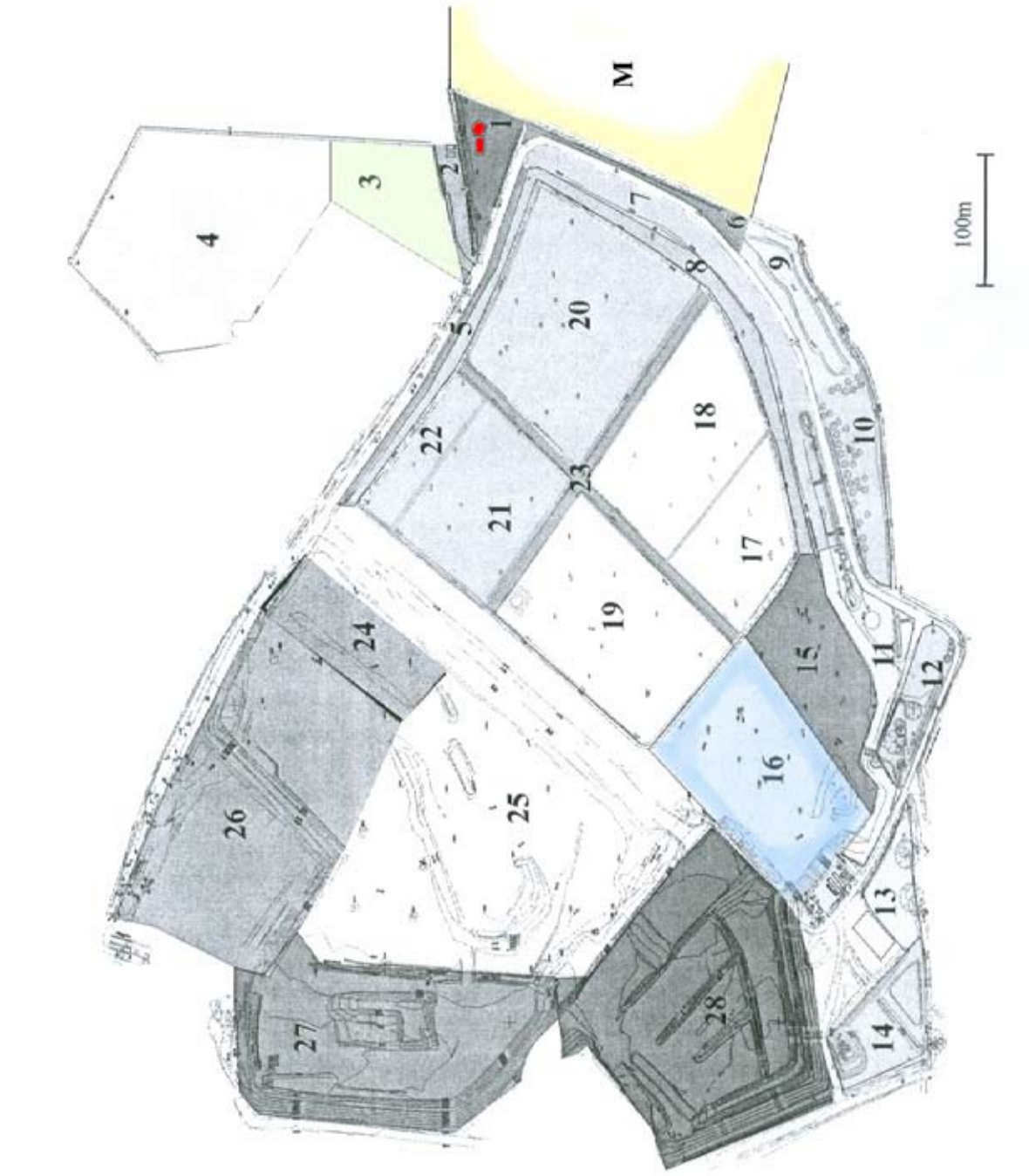


Figure 8.1 – Map of the land managed by the Carymoor Environmental Trust

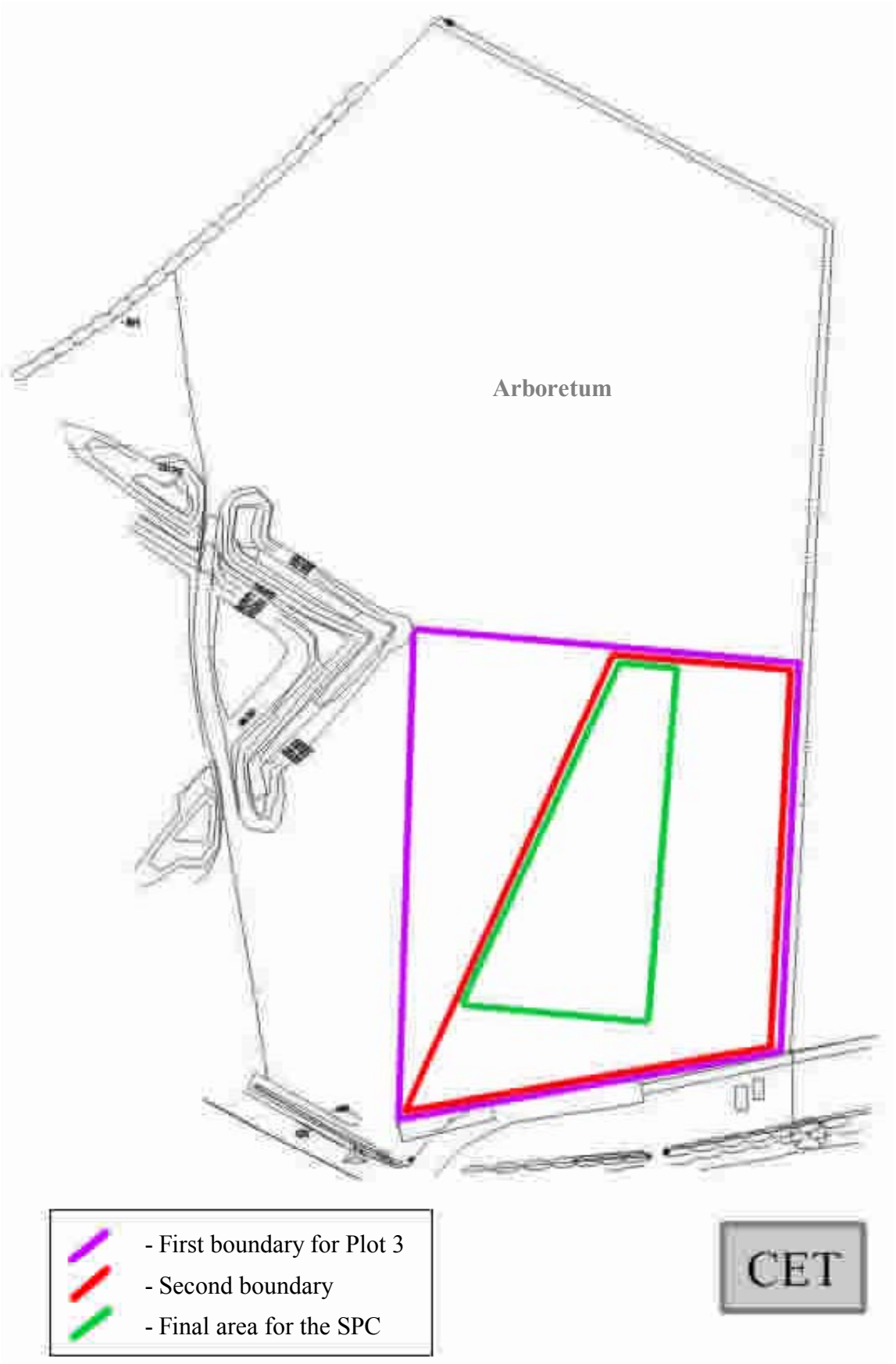


Figure 8.2 - Map of Plot 3 & 4 showing the changes of boundary to plot 3

8.3 Possible Ways to Develop a Collection

A plant collection can develop in a number of ways depending on the proposed purpose of the collection and constraints imposed by finances and resources. This section will examine the options that were open to Carymoor Environmental Trust (CET) and highlight the implications of each option.

8.3.0.1 Nature Reserve

The presence of an existing habitat, or network of different habitats, that warrant preservation would suggest that the creation of a nature reserve rather than a botanical collection would be preferable. As a naturally occurring habitat rather than a man-made display, CET would have a duty of care to continue whatever management is needed to maintain the existing conservation value of the habitats and possibly improve other areas. In this situation, the conservation role would probably become the primary purpose of the organisation with education or recreation activities being fitted around what is best for the reserve.

The results of the market research (chapter 7 page 254) show that while university lecturers make use of nature reserves (94% of respondents indicated they use them) they are unlikely to travel specifically to one located on the Carymoor site unless there was an exceptional reason. The results also showed that nearly all schoolteachers (99%) perceived nature reserves as being valuable for teaching. Both schoolteachers and university lecturers identified plants grouped by habitat as being the primary method of displaying plants they would want to see used. This naturally fits in well with the structure of a nature reserve. However, both groups also expressed desires to see plants grouped to show adaptation and evolution, as well as plant families. To do this in a nature reserve would require the application of a different set of aims and management criteria to a specific area, in effect the creation of a garden within the nature reserve. The viability of the site as a suitable location for training of professionals would be dependent on the type, quality and range of habitats present. It is however unlikely that the habitats would vary widely enough to offer the range of species of the genera desired for professional plant identification courses.

Based on the description above the resultant organisation would probably resemble organisations such as the Wildlife Trusts. The Wildlife Trusts is a partnership of 47 independent wildlife charities distributed throughout Britain. Together the trusts are responsible for managing 1,285 reserves totalling 80,988hectares. The trusts are funded through the subscriptions of their members, which total over half a million, and project funding from various sources including the Heritage Lottery Fund. However, the money raised for the day-to-day running of the trusts is only enough to pay a small permanent staff (1,731) and thus a lot of the work is done by the trusts' 26,684 volunteers (Wildlife Trusts Website 2004). Research work conducted by the trusts is limited to specific projects for which funding can be gained.

8.3.0.2 Created Habitats

The creation of a nature reserve, as outlined in the scenario above, assumes that the area under CET's management is of conservation value. If however, as is the case with the capped landfill at Carymoor, the site is of little conservation importance an argument can be made for the creation of habitats. This provides an opportunity to develop the site in a manner that is more conducive to use by the various groups. However it does not provide a solution to the desire of schools and universities to see plants arranged by families and their adaptations and the created habitats will be of less value to professionals wishing to develop skills in habitat identification.

If neither of these two large-scale habitat arrangements of plants can satisfy the requirements then one of the following garden orientated arrangements may be more suitable.

8.3.0.3 Ornamental Garden
An ornamental garden could be created using only native species. However, by itself this would only fulfil to the recreation role associated with botanical collections and therefore would not be considered a solution for an organisation with an educational aim. To understand what is required to change an ornamental garden into a botanical collection fulfilling more than just a recreation facility the requirements and consequences for the roles of conservation, education and research will be examined independently.

8.3.0.4 Conservation
A method for the fulfilment of some conservation roles has already been illustrated in the section above dealing with nature reserves. This highlighted the suitability of nature reserves for *in-situ* conservation of existing species. However, if a garden does not have an area of habitat worth conserving *in-situ* other methods of fulfilling a conservation role must be sought. As was discussed in the conservation section (page 166) of chapter 4, the traditional view of a botanical garden's collection being an 'Ark', and that the presence of a species within it meant that that species was safe, is false. A more sound use of living collections for conservation is in a short-term capacity where one or two species can be taken from a threatened location, bulked up, and then returned to a similar site. The short-term nature of the programme allows for maintenance of a greater number of accessions than would be possible over longer periods, thus maintaining the genetic integrity. The Ness Botanic Garden in Liverpool has successfully run this type of programme, (Hatton 2004 pers. comm.). Specific facilities such as micro-propagation units and seedbanks, can be useful conservation tools. In the case of seedbanks allowing long-term storage of genetic material in a way that prevents crossbreeding. Micro-propagation units allow the rapid bulking of material and the germination of otherwise difficult plants. There is an alternative method of fulfilling a conservation role and that is through education. As Luscombe and Scott (2004) state "conservation can have little meaning if it does not affect our everyday lives and is confined to sites of strictly scientific interest." By attempting to change the attitudes of people towards plants, an organisation is helping them to understand the need for protecting plants and the other organisms that rely on them, thus delivering an important part of conservation, that of the support and understanding of the public. The Eden Project is a good example of an organisation with this approach (see chapter 6 page 234)

However, with the possible exception of the last approach none of these methods require gardens to house the living components of the collection; indeed micro-propagation units and seedbanks need only a nursery facility and holding area for bulked material waiting to be reintroduced, and as a result any visitor attraction element to them would be additional to their need, unless it was the means by which they were funded.

8.3.0.5 Research
None of the respondents to the botanical collection survey indicated that their collections concentrated solely on research; instead research was an activity that occurred alongside others. This is not surprising as the topic of research is usually linked with these activities, for instance research into a plant that is subject to a reintroduction program, the effectiveness of an educational activity or monitoring of the ecology of an *in-situ* conservation area. Invariably the employment of a member of staff with the specific task of research does not generate enough income to cover their employment, which probably explains why 7 of the 16 respondents from non-university botanical collections (44%) that stated that research was one of the roles of their collections also stated that they did not employ a member of staff specifically for this. To be viable an organisation must be able to compete for research funding from external sources. This external funding is subject to trends, for instance molecular and genetic research is popular at present and it is no coincidence that the Royal Botanic Gardens, Kew, which employs 76% the of researchers working in non-university botanical collections, has a laboratory

specifically for this. However, employing staff specifically for research is not the only way of having a collection that is used for research. The Eden Project case study (chapter 6 page 234) illustrates how partnerships with other organisation can result in research work being conducted at little or no cost to the collection. Carymoor has already entered into such partnerships with universities and other organisations, although these have involved other aspects of Carymoor's operations, this thesis could be the first of many research projects involving the Somerset Plant Collection.

8.3.0.6 Education

Section 7.10, Ramifications for Botanical Collections (page 320), outlines the different requirements of visitors from a botanic garden including their differences in educational requirements. These range from botanically accurate collections of specific genera for professionals to more diverse collections arranged by habitat and taxonomically for school and universities. These differ in the amount of space and horticultural skill required as well as the level of display quality and thus cost. For example, the purpose of habitat creation for schools would be to provide the student with an experience of each habitat from which simple principles could be discussed. To achieve this a rough approximation of the actual habitat will suffice. However, the creation of a habitat display for university students, who ought to be viewing the display from a more knowledgeable position, would need to be more botanically accurate. A collection, such as grasses, required by professionals could plausibly be grown in pots in a nursery situation. If a nursery were already being maintained this would cost less than displaying them within a garden context. However, a higher degree of botanical horticultural skill would be required to keep such a collection to the standard required to run identification workshops for professionals.

Educational visits generate less income than other visitors and invariably the garden has a discount rate for school group admissions. They usually bring their own food and therefore do not purchase from the gardens restaurants or cafés. In addition to this many receive staff time for part or the whole of their visit, a cost that does not have to be met for recreational visitors. Ellison (2004 pers. comm.) has demonstrated at RBG Kew that by using a combination of volunteer staff and staff paid on a *pro rata* basis, in a situation where large numbers of school children can be transported easily to the garden, it is possible to run an education unit that is self financing. However, it will probably never reach a position where it is making a significant financial contribution to the botanical collection it uses. The results of the botanical collections survey (chapter 2, page 25) allude to this. Of those botanical collections that responded to the survey, and were subsequently classified as group E collections, indicating that they have only education and recreation as roles, less than half (45.5%) employ a specific member of staff to deliver this educational role. The rest rely on combinations of passive media such as guidebooks, labels, display boards, video and film to inform their visitors. It is therefore clear that any garden wishing to have education of schools as a primary aim can only do so in conjunction with an alternative funding stream.

8.4 Designs

The discussion above illustrates that the feasibility and sustainability of the SPC are, to a large extent, dependant on decisions and policies that fall outside of the design of the structure and landscaping of the collection. Initially it was decided that the SPC would be a 'honey-pot' attraction, used to draw visitors to the site. With this in mind the following design for a high-cost visitor attraction that would fulfil the CET's educational aims was developed.

8.4.0.1 Master Plan

Many museums and botanic gardens concern themselves with telling the stories of the objects/plants in their collections. With the SPC there was no existing collection to be incorporated so there was a certain amount of freedom to turn the usual process on its head and choose a story first and then find

the plants with which to illustrate it. Discussions with the CET staff had defined the broad topic the SPC would cover as being the interaction between plants, science and humans. The primary audience had also been identified as school groups. Therefore to refine this "plants, science humans" topic into a set of stories around which a collection could be based, the national curriculum was consulted (National Curriculum Online 2003) and a number of relevant topics extracted. The resultant topics could be sorted into six broad groups (see Appendix 5 for a full list of this division).

- Plant Physiology
- Plant Evolution
- Biodiversity
- Plant Ecology
- General Ecology
- Ethnobotany

It would have been possible to stop at this point and create a garden with six areas each one with exhibits and collections dedicated to one of the above topics. However, all these topics are intrinsically linked and as we have seen with the method loci described in education theory section in chapter five (page 193) a route through a physical space can be used to aid the remembrance of an argument. Therefore if the space itself is created in a way that aids this use, i.e. there are distinct areas with elements spaced 9m (30 feet) apart etc. the story told by the garden should be more accessible to the visitor and more easily remembered once they have left. From the topics already chosen and the elements within these that are required for the national curriculum an argument could be constructed in the following manner.

- ❖ Plants are constantly growing, producing offspring and dying (Physiology Section).
- ❖ This process allows plants to change over many generations to get the best from their environment (Evolution Section).
- ❖ Because this process has been going on for millions of years plants now come in many shapes and sizes (Biodiversity Section).
- ❖ Groups of plants often share similar optimum conditions and are therefore commonly found growing together (Plant Ecology Section).
- ❖ Just as plants have adapted to get the best out of their environment they have also changed to make use of the animals and insects in their habitat. The reverse is also true and animals and insects have adapted to use the plants (General Ecology Section).
- ❖ As a component of the environment Humans have in the past and continue to use plants, this use results in change of the environment and the plants (Ethnobotany Section).

Each of the six elements of the argument could be considered as a gallery within a museum, each with its own exhibits telling stories related to the main theme of that particular gallery. The verbal argument above is, by the very nature of text, linear, but in reality certain topics can be approached from different angles. For example, genetics can be discussed equally legitimately as a sub-topic of evolution (i.e. how evolution is a series of genetic changes) as it can as a sub-topic of ethnobotany (i.e. how we have manipulated genes for our own uses). These additional relationships between each of the six elements can be illustrated diagrammatically (see Figure 8.3).

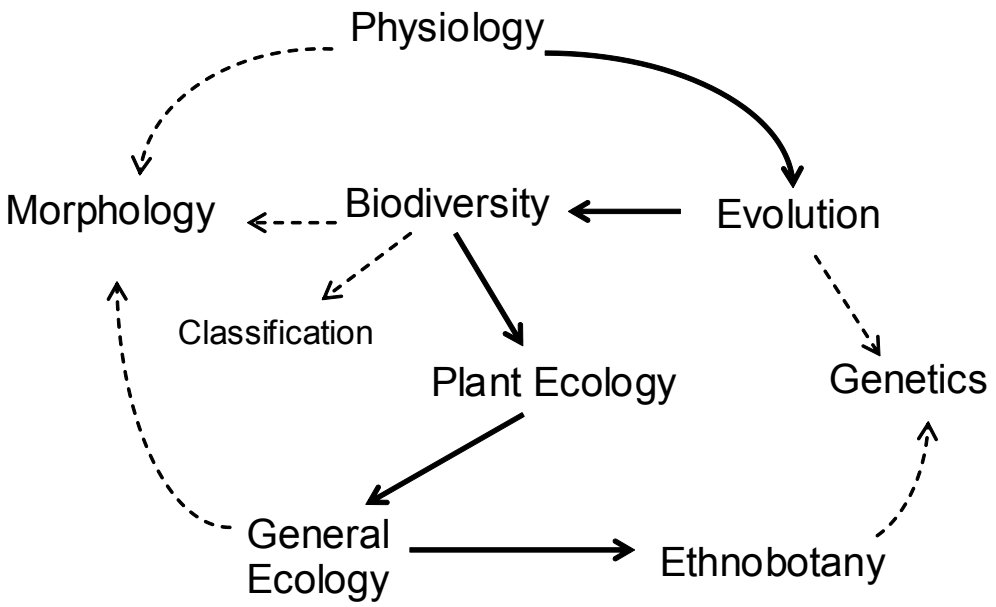


Figure 8.3 – Relationship between the elements of the argument

The illustration of how the different elements of this argument are linked (Figure 8.3) can be used as a guide to how the galleries addressing each of these topics should be arranged spatially in the garden. In Figure 8.4 below the previous illustration has been reworked to with the galleries differing in size depending on the amount of space that is needed to exhibit its contents. The orange arrows indicate the primary route through the argument and therefore also the garden.

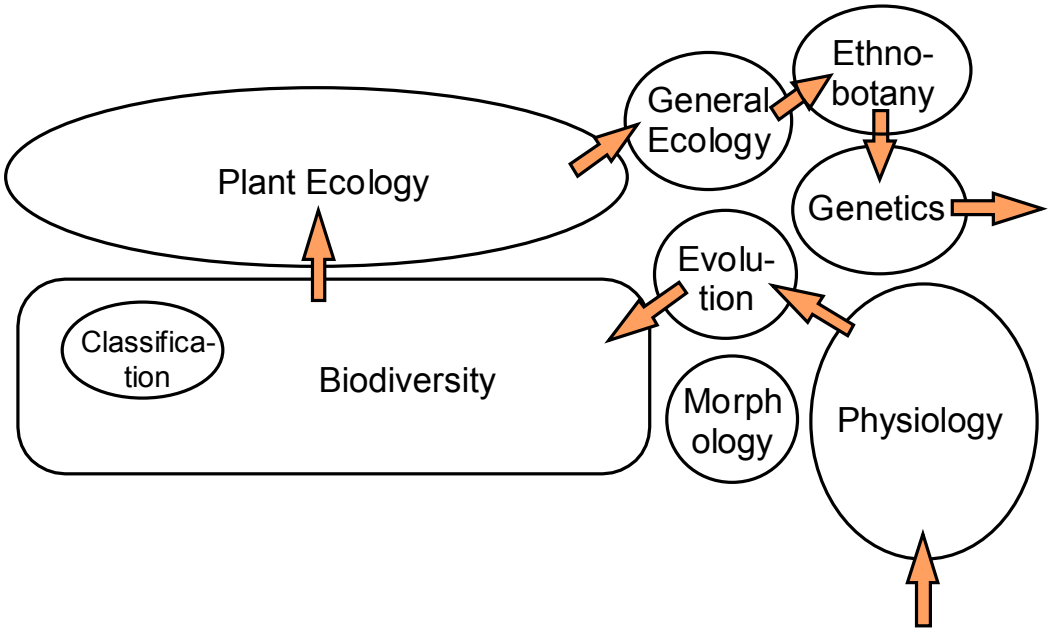


Figure 8.4 – Rough plan of the size and relationship of the galleries

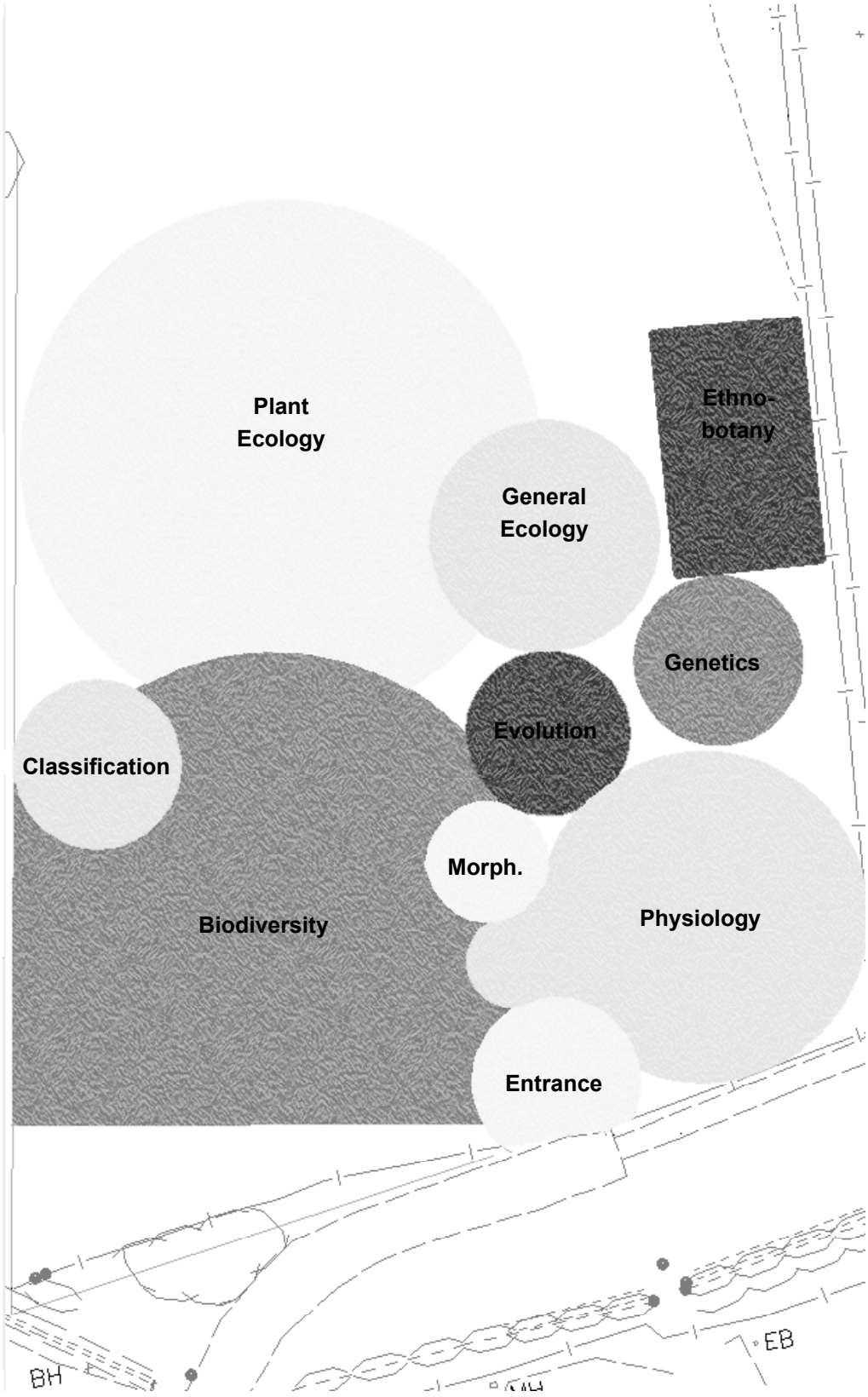


Figure 8.5 – Conceptual layout fitted to plot 3

Figure 8.6 - Primary path around the site (at least 2-metres wide and capable of taking light horticultural vehicles)

Figure 8.5 above shows how the conceptual layout shown in Figure 8.4 (page 337) was fitted into plot 3 on the Carymoor site. Figure 8.6 shows the primary route through collection, which not only guides the visitor in a logical way through the collection but also provides vehicular access for horticultural machinery to all sections of the garden. It may be noted that in addition to the six elements discussed so far there are an additional two areas. As the model used to create this design originated from the education policy and therefore did not include horticultural elements, a nursery area was added where a polytunnel already exists. The second added area is labelled "Entrance" on the diagram. This was included for two reasons firstly as a safe area in which school parties can gather before starting their tour and secondly to provide an exhibit area that can be changed frequently to display exhibits on topical themes relating to the topics discussed else where in the collection. A general impression of the garden built to this plan is shown in Figure 8.7.

The overall design of the garden is only the framework onto which individual exhibits can be hung. Just as a dialogue was created to illustrate the overall message that the collection as a whole was to impart, to the visitor the same must be done for each of the galleries. The development of the content of the plant ecology section can be used to illustrate this procedure.

The plant ecology exhibit had a very simple message to convey. The aim was to demonstrate to the visitor that:

-Variations in the environment result in different plant assemblages
-Plants do not all grow in the same places

To achieve this, two exhibits were devised. The first addressed the 'variations in the environment' statement and consisted of two long beds with a varying environmental gradient from one end to the other. For instance, a recreation of a section of Somerset Levels taken from a water filled ditch at one end to higher/dryer ground at the other could be planted to show the changes in plant assemblage caused by the differing height of the water table.

The aim of the second exhibit was to address the statement that plants do not all grow in the same places. To do this the diversity of habitats in Somerset should be demonstrated. The National Vegetation Communities, as given in the 'British Plant Communities' series edited by J. S. Rodwell (1991a, 1991b, 1993, 1995 & 2000), seemed a logical basis for this exhibit because it provided detailed information on the species composition and frequency. However, because of its detailed nature, creating all the NVC habitats found in Somerset would require a large number of beds, many of which would superficially look the same. Therefore a much broader representation of the counties habitats would be needed. English Nature has "examined the local distinctiveness of each part of England and identified its characteristic wildlife and natural features". From this they have divide England's habitats into "97 terrestrial and 23 maritime Natural Areas" (English Nature Website 2004). Somerset has ten of these Natural Area types (Figure 8.8), which is a far more manageable number for display purposes.

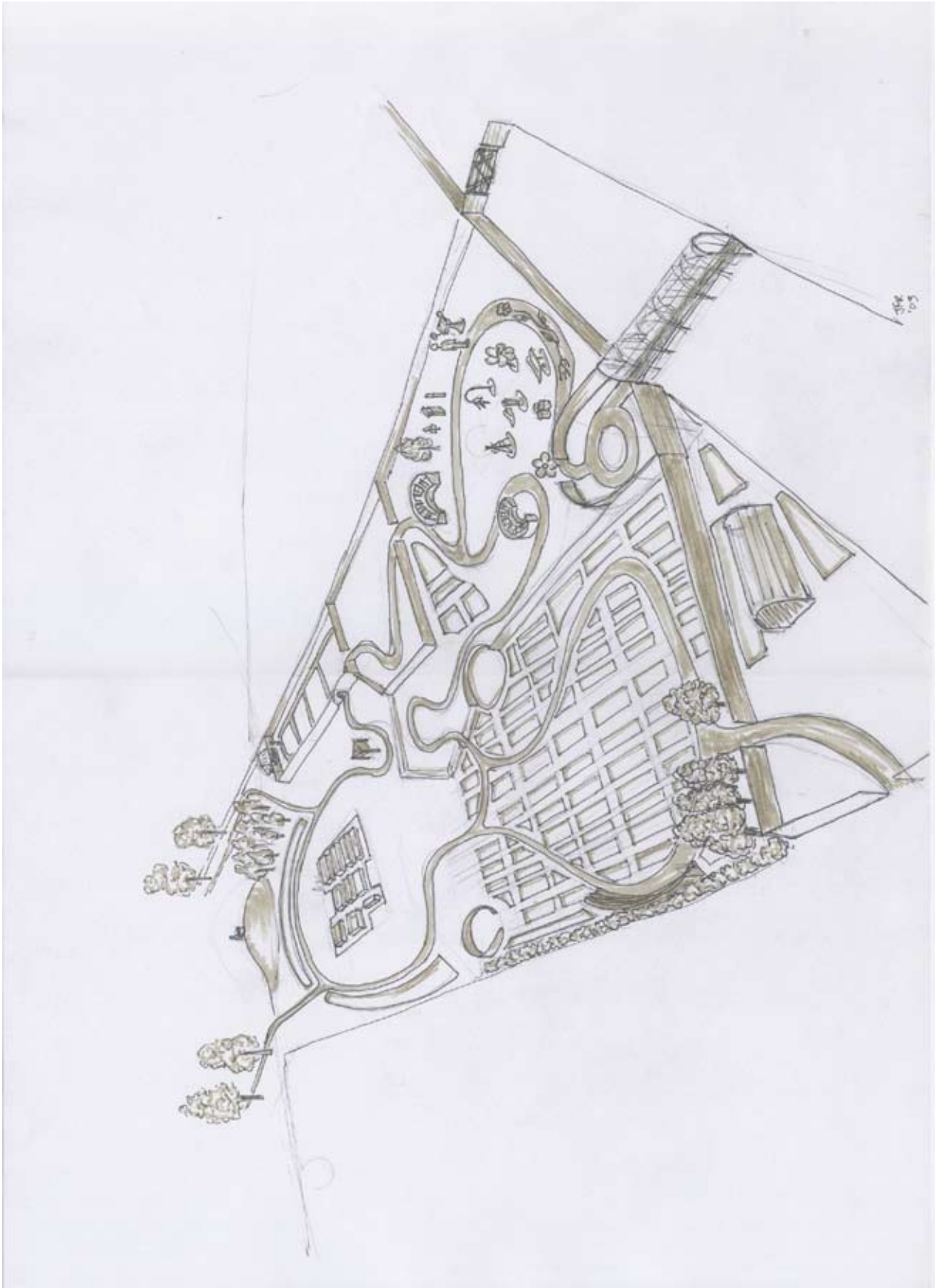
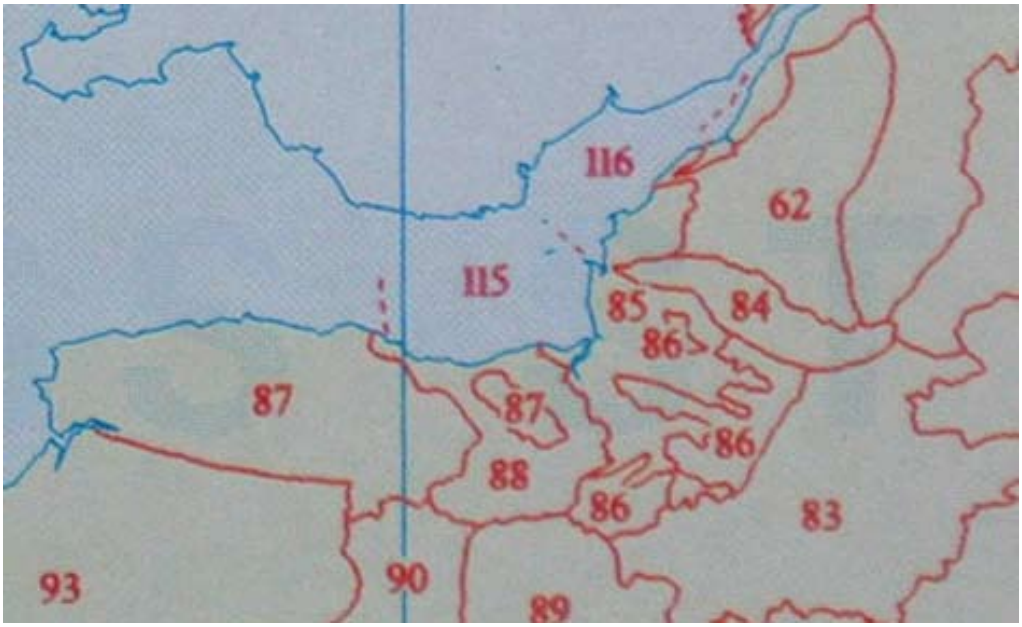


Figure 8.7 – General impression of the Somerset Plant Collection



No.	EN Natural Area Name	No.	EN Natural Area Name
83	Wessex Vales	87	Exmoor and Quantocks
84	Mendip Hills	88	Vale of Taunton
85	Somerset Levels and Moors	89	Blackdowns
86	Mid Somerset Hills	115	Bridgewater Bay

Figure 8.8 – Extract from English Nature Natural Areas map (English Nature 2003) showing natural areas in and around Somerset

Figure 8.9, on page 345, shows the design for an exhibit incorporating these ten Natural Area types. The beds have been laid out to represent the county so when viewed from left to right (West to East) the visitor passes from marine habitats, through habitats associated with the Somerset Levels and agricultural land into the grassland and pasture of the East of the county. Capping the retaining walls of each of the beds with the dominant rock of that area could reflect changes in bedrock across the county and therefore add additional information for discussion on the causes of differences in plant assemblage.

The finished gallery could be used as follows. To reach this part of the garden the students will have walked through the physiology, evolution and biodiversity galleries, they may also have looked at the plant morphology display so hopefully be aware of how plants work, that there are many different types and that these have come about by evolution. When they reach the ecology gallery they may first go to the Somerset habitats display where, having orientated themselves using a map of Somerset showing the different habitats and how this relates to the beds in front of them, they may be lead by a teacher or member of staff on a walk from the coast inland to their school or perhaps the CET centre. After they have become familiar with the display they may be prompted to consider whether all the plants are the same, and why these differences might have occurred. This discussion may link back to some of the plant adaptations seen in the morphology section. The students could then be sent off to find, using the interpretation on each bed, examples of plants that are found in only one habitat and a list of those that occur more frequently. From here the group may move on to the environmental gradient beds and discuss whether the habitats seen in the last display are the only ones that exist (e.g. what about woodland?) and whether there is a smooth transition between habitats or

a definite boundary. The students could be asked to think of examples of both. Depending on the age of the group, they may be split into groups and positioned along the gradient and given the task of estimating the amount of certain species present. The results of these could be added to those of the other groups and discussed.

This design for this garden as a whole seems to offer a neat solution that incorporates the topics that CET wanted included in a way that should help the student to understand and remember. However, having observed first-hand how school groups function during visits to the Eden Project and following discussions with Sam Kendall (Eden Education Team), it has become clear that if an exhibit is to be used by visiting school groups it must have a series of start points and not be reliant on being completed in a certain order. This is to allow the groups to be dispersed over the site to prevent queuing to see a certain point of interest. The proposed design may be more suited to a situation, such as a school, where numerous visits can be made and a greater familiarity with the site gained.

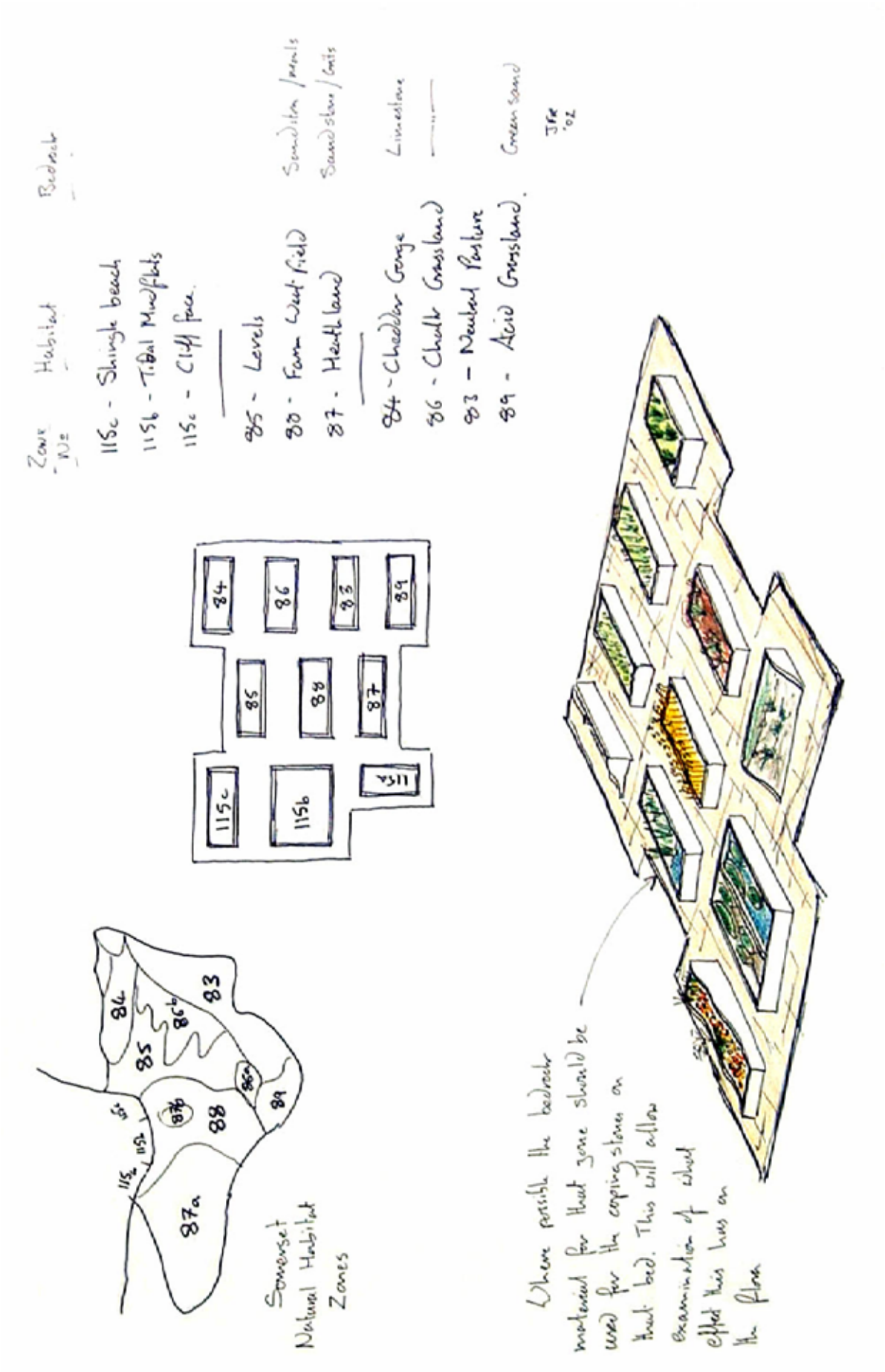


Figure 8.9 – Initial designs for a display of Somerset habitats

8.4.0.2 Three Modules

The master plan described in the previous section was created, as originally required by CET, with the aim of creating a visitor attraction with no set budget. The resultant design would cost a significant amount to create and its maintenance would require fulltime skilled horticulturalists. As has been noted, education departments in botanic gardens can, at best, breakeven but do not generate enough profit to fund the maintenance of the garden they operate in (Ellison 2004 pers. comm.). Therefore the SPC would be reliant on other sources of funding, most probably revenue from non-school visitors. However, a solution has not been found to improve the suitability of the site for large numbers of visitors so this revenue stream is too limited to support such a venture. With this in mind the CET re-evaluated the design brief, deciding to limit the collection to three topics; biodiversity, conservation and ethnobotany. These were to be covered in three separate modules that could be built in phases as funding permitted. Of these, only the first two, biodiversity and conservation, were developed to a stage worthy of discussion here.

Biodiversity/Stock Bed Module

The biodiversity module was designed to fulfil two main roles: firstly, to provide an educational display that addressed the topic of biodiversity, and secondly to provide an area that could be used as a stock bed to grow material for propagation and sale. No decisions had been made as to what topics within 'biodiversity' were to be covered so the display had to be simple and flexible.

As the most obvious way of displaying the variety that can be found in the plant kingdom is through the use of order beds, and the fact that this had scored highly with schools as a desired method of plant display (see the results of the market research in chapter 7), the final design, consisting of an elliptical arrangement of beds with an outer and inner ring and grass paths separating the beds, was based on a order bed system. In order to accommodate the flexibility required by Carymoor for a collection that will grow spasmodically, and could possibly have a number of different people managing it, the plants are to be arranged taxonomically as given in the '*New Flora of the British Isles: Second Edition*' by Stace (1997). Figure 8.10 shows how each pair of beds that radiates from the centre is designed to hold a specific sub-class of plants. Within these beds the plants will then be separated further into families and genera using moveable labels. The area of the beds allotted for each sub-class is representative of the number of plants in that taxa growing in Somerset. The beds are capable of accommodating one specimen of all the herbaceous plants and small shrubs growing in Somerset. As plants are added to the collection it will grow to fill the inner ring then expanding into the outer ring. The radial arrangement of the beds, unlike the usual grid arrays, should also reduce the number of plants that have to be moved when new species are added.

As the beds are filled from the centre out those in the outer ring will not be needed for the collection straight away. This gives the opportunity of using them to generate income for the collection; their larger size means that plants could be grown on a small agricultural scale to provide material for dyeing, educational packs etc. By grouping the plants by families and sub-class the biodiversity of the plant kingdom is illustrated and from this the similarities and differences of the groups can be discussed.

The large central grass area will provide a useful meeting point for school groups. From here the teacher or member of Carymoor staff leading the group can send the students off in small groups to study, draw and compare the various species in the display whilst remaining in a central position to monitor them and answer queries. For more advanced students the circular arrangement means that similar species are always located close by and yet, using central space, one can move rapidly between sub-classes. A balance must be found between the capital cost of creating the design and the cost of maintaining it. For example, the radial and circular paths could be grass. This would greatly reduce the cost of creation but lawns, as illustrated by the botanical collection survey (Table 2.15 page 45), require high levels of maintenance. Hard landscaped paths would be expensive to build but would then require negligible maintenance from then on.

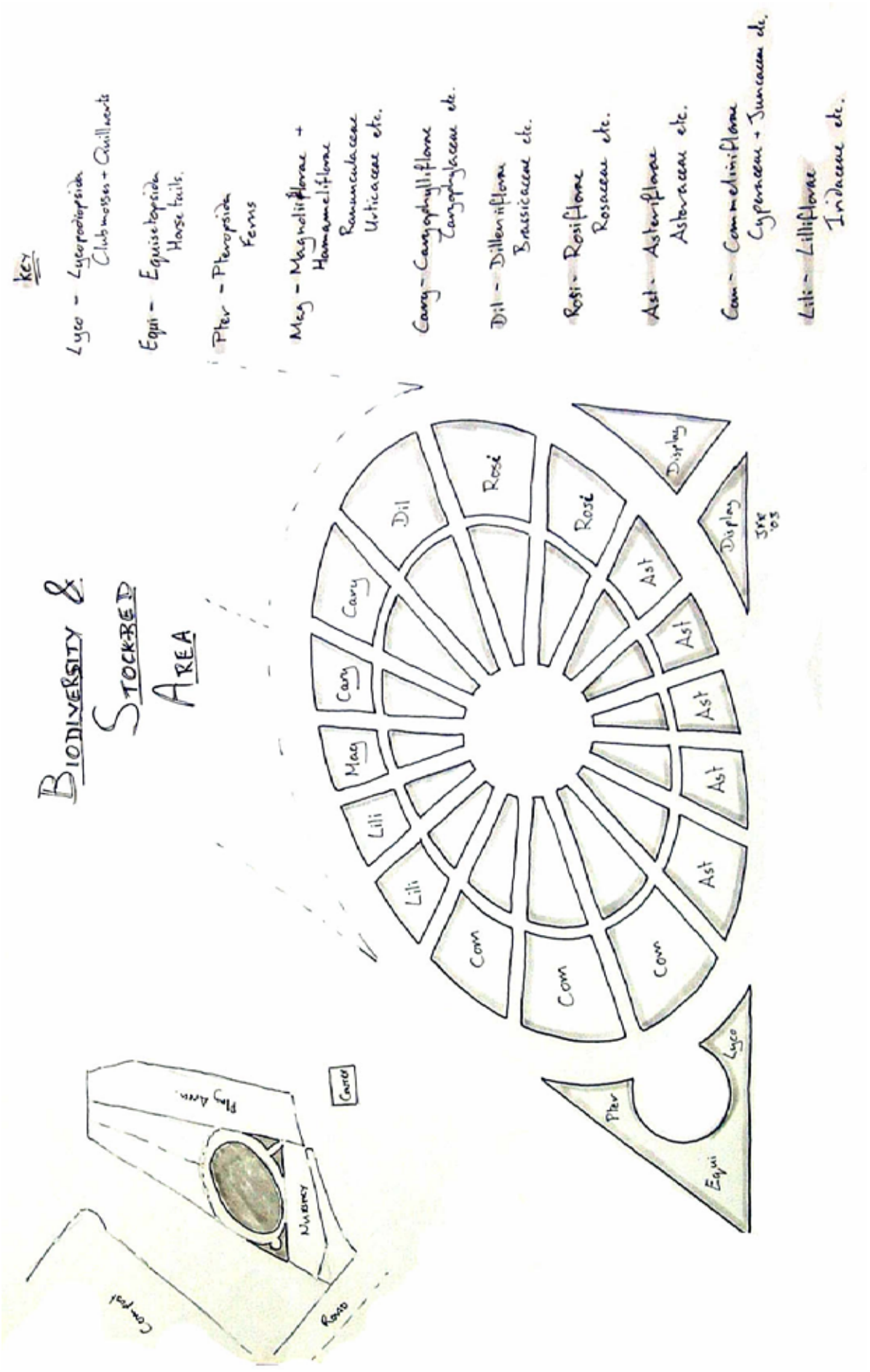


Figure 8.10 – Design for the biodiversity & stock-bed section

Conservation Display Module

When considering how to approach the issue of conservation using a living display two possible solutions were identified: either the display of rare and endangered species, with a discussion as to why numbers have dwindled, or alternatively a display of habitat degradation and a discussion of why this has happened and whether it matters. Effectively the decision was whether to discuss conservation at a species or habitat level. While both are important topics and both have the same ability to act as a starting point for discussions on the wider topics of conservation such as social responsibility and the relative worth of plants, the habitat level seemed better suited to Carymoor's needs. A species level conservation display would require species to be grown that are rare and therefore difficult to obtain, many requiring a specific licence for collection (see section 4.3.1.2 'Legal Requirements', page 160). If the plants subsequently died through poor collection management this could prove a significant loss to conservation.

With these points in mind the following display (Figure 8.11) was designed. It consists of four beds surrounded by grass paths and with a large central grass space. Beds A, B and C are sown with an old wheat variety (i.e. long stemmed, low yield) and a selection of annual arable weeds such as poppy (*Papaver spp.*), corncockle (*Agrostemma githago*) and corn marigolds (*Chrysanthemum segetum*). In contrast, bed D is sown with a modern wheat variety (i.e. short stemmed with high yield) and kept free of weeds with a spraying regime, as would happen in the fields surrounding Carymoor. The long narrow beds maximise the amount of edge space to volume therefore aiding maintenance and increasing the amount of students that can work on one bed at any one time.

This exhibit would be used by the visiting schools to conduct a variety of exercises. For instance, the two different regimes could be examined to determine the differences in yield, the heights of the crops, and the number of plant species. The groups could then come together to discuss why the two regimes are different what effect each has on the environment, the effect they have on humans and whether we should return to a highly contaminated, low yield crop to benefit wildlife or stick with our clean, high yield methods? Or is there another option? This exercise would hopefully get the students thinking about some of the difficult and conflicting arguments that need to be considered when trying to strike a balance between what is good for us in the short term and what is good for the environment in the long-term.

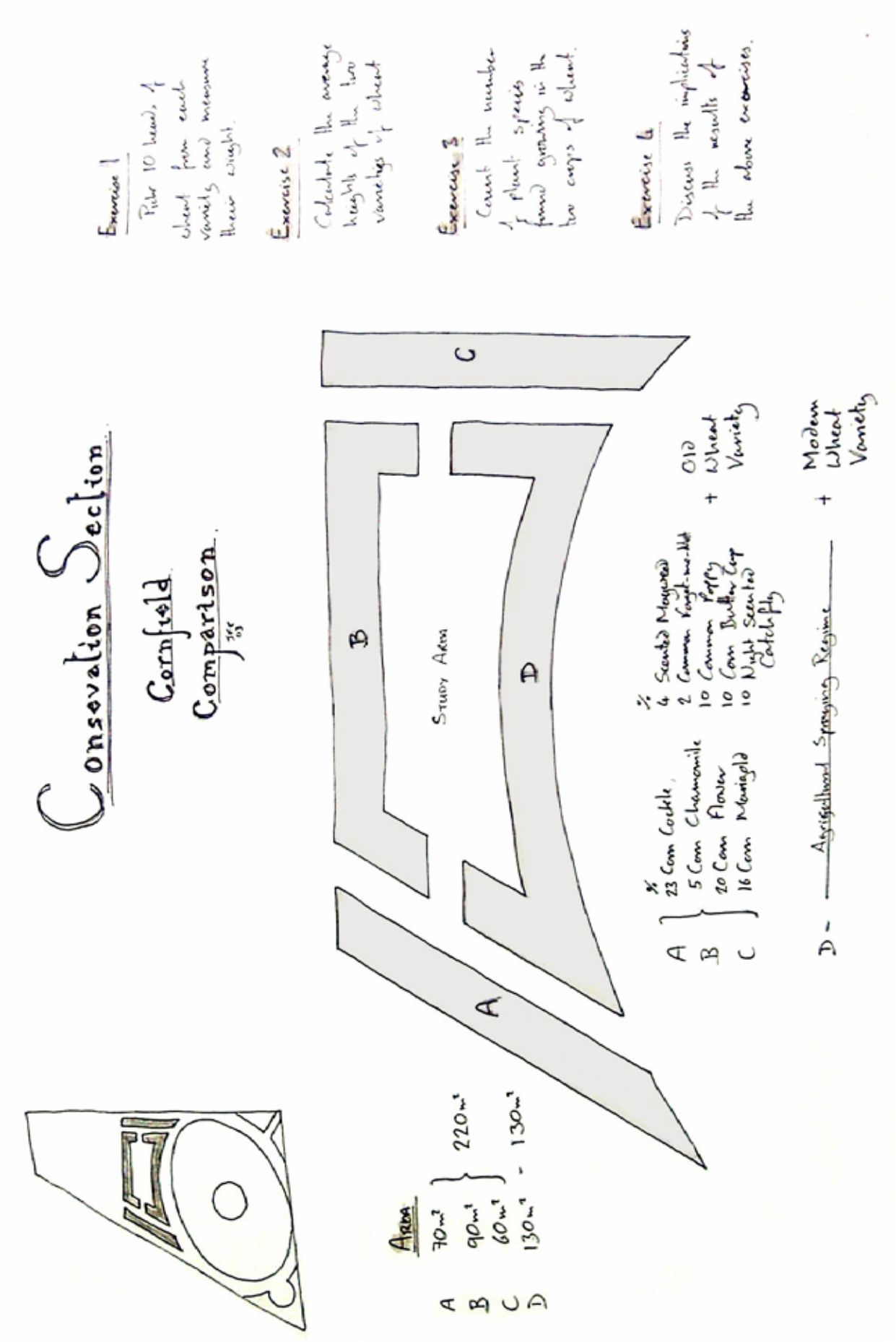


Figure 8.11 – Design for the conservation section

Of the designs for the three-module brief, only the biodiversity/stock bed design and the conservation display were taken to a stage where the cost of creation and maintenance could be assessed. In both cases the cost of creation could be kept to a minimum, as in their basic form all that is needed is the creation of beds in existing turf. Requiring only a seasonal sowing, the conservation display would not be too labour intensive and could therefore be managed within the present structure. The biodiversity/stock bed area, as a collection of herbaceous borders maintained in taxonomic order, would require a greater amount and skill level of labour although the original concept behind the design was that it aided the production and sale of materials, the proceeds from which would be put back into running the collection. In both cases interpretation could be expensive depending on whether professional signage is utilised or whether handmade signs are used, which, while maybe financially cheaper, are more time consuming.

8.5 Discussion

The author's role in this project was to look at the feasibility, structure and design of a plant collection at Carymoor. The results of the market research conducted on the possible stakeholders of this project showed that there was a demand in all sectors for a botanical collection of some sort. However, the type of collection varied, as did the associated requirements, many of which were outside of the bounds of the garden design. The need for additional parking greatly decreased the ability of the site to accommodate a public garden, as had been desired. This in turn also reduces the amount of income that it can generate. Based on the average figures for running botanical collections obtained from the botanical collection survey (see chapter 2, in particular Table 2.35 on page 66) the SPC, if it occupied the original 1-hectare site, could cost from £1,030 p.a., if run as a private garden, to £57,000 p.a., if run as a conventional botanic garden (group ABG), or £428,700 p.a. if modelled on a group B garden. The range of costs illustrated here suggest that a financially viable solution could be found but that it would probably not be a botanical collection operating in the traditional areas of research, recreation, education and conservation that had been desired from the start. The lack of a solid master plan for the Carymoor site as a whole meant that the position of the SPC both physically on the ground and within the overall business plan of the centre was in a constant state of flux. Indeed when the activities of a traditional botanic garden are compared with the aims of the CET (see below) it can be seen that a lot of what was suggested could be deemed as stepping outside of these.

- Increase awareness of biodiversity and sustainability
- Conduct educational programmes on biodiversity and sustainability
- Manage the land for wildlife and nature conservation
- Provide the local community with an Agenda 21 activity centre

(CET Website 2003)

In order for the SPC to progress it is important that its position and future roles within the CET are agreed by the Carymoor staff and that this is included within the centre's business plan so that it can be referred to at a later date. This should also include details of a mechanism by which money is to be raised for the construction and the maintenance of the garden. Once this has been done, and assuming that a sustainable source of income has been identified, there are two ways that the creation of the garden could be achieved. Firstly, with a large capital investment resulting in a quick build or, secondly, with smaller capital investment over a longer period.

Large Capital Funding Quick Build

This is similar in approach to that described in the case studies of the Eden Project and the National Botanic Garden of Wales (chapters 3 & 6). With this approach, the design and structure of the garden are developed, probably in this case by a consultant, and then the garden is built quickly and completely

using a lump sum from an investor, benefactor or fund. This should result in a complete and staffed collection that is in a position to start generating money to cover its maintenance. However, as the National Botanic Garden of Wales demonstrates, this quick build approach places a lot of pressure on the organisation to meet the predicted turnover for the first years otherwise the project and quickly founder.

Small Capital Slow Development

Without a large initial investment it may still be possible to build a collection with a small capital investment, provided one has the time and committed staff. The cost of an instant build is high because contractors are being brought in and brand new commercially available materials are being used. However, if the creation of the garden is being conducted in-house there is greater flexibility, which allows materials to be begged, borrowed or reclaimed (especially if the organisation has charity status). This approach requires at least one member of staff whose sole job is the creation of the garden. However, this approach does mean that there will be a longer period between the start of the project and the point at which it can start generating income.

The final designs for this project concentrate heavily on schools education because this was the only area that was constantly agreed upon by all elements within the CET. However, if, once the roles of the collection had been clarified, this process were to be repeated, greater consideration would need to be given to how the design of the garden affects the other roles of the collection such as recreation, conservation, research etc. For example, other botanic gardens such as Ness Botanic Gardens, Liverpool, and the University of Bristol Botanic Garden have areas set aside for research (Hatton 2004 pers. comm.; Memmott 2004). If this sort of facility were required, provision would have to be made for it in the design stage, especially if, as at Carymoor, there is limited space in which to expand later.

The discussion so far assumes that a sustainable source of income suitable for creating and maintaining a garden can be identified. However, if this is not the case then other ways of achieving the aims could be reviewed. For example, the site already has a number of different habitats and a good range of plant and animal species. Using these a member of the education staff, perhaps utilising environmental education techniques such as those described by van Matre (1999) (section 5.1.2), could create an education programme for visiting schools that fulfilled the centre's remit to educate and inform about biodiversity and sustainability as well as national curriculum learning outcomes. One of the important elements in such a programme would be immersion, i.e. providing the student with an experience on which the learning can be hooked. The area designated for the SPC and its budget could be used simply to create a habitat, such as the Landlife wildflower meadows (see page 120), within which the students can walk, sit, and pick flowers. This would be far cheaper to create and maintain (see Table 2.15) than a traditional living collections and, if linked with a suitable education programme, would provide a valuable experience.

One of the problems already discussed is the prohibitive cost and logistics involved for schools when trying to visit places with their students. Getting to rural locations such as Carymoor usually requires the hire of two 53-seat coaches as well as additional staff to supervise the students. The cost of these is greater than the fee charged for the day at Carymoor. However, CET could run an outreach programme where a member of the centre's education staff visited schools to conduct an education programme that included supporting material, such as plants grown at Carymoor. This would be viewed favourably by many schools as it removes the cost of coach hire and the need to provide extra staff and collect consent forms etc. from parents. As there is no time taken up with travel the programme could last for half a day and be run twice, allowing two shifts of pupils in a full day, possibly increasing the number of students participating. For CET the fact that the schools are not paying for coach hire may allow them to charge a higher overall rate for the day. This combined with the ability to accommodate more pupils in one day would increase the gross profit increasing the feasibility of the venture.