

Centre for World Environmental History

Collaborative research on the meteorological and botanical history of the
Indian Ocean, 1600-1900

Conference Transcript

**University of Sussex
December 5th and 6th 2012**

The conference began with a welcome from head of History at Sussex, Jim Livesey who emphasised the importance of interdisciplinary groups such as CWEH to the continuing pursuit of Asa Briggs' original vision for the University, the creation of new paradigms of knowledge to tackle the world's most pressing problems.

Following Jim Livesey, the CWEH director Vinita Damodaran set out her vision for the conference:

It gives me great pleasure to welcome you to this first network meeting on the botanical and meteorological history of the Indian Ocean world, I'd like at the very start to thank George Adamson and Anna Winterbottom who, from the beginning, have been very important for the vision of the project.

The Network aims to address some of the most serious challenges to the future of humanity; global warming, extreme climate events, deforestation, desertification, famine and inequity through a interdisciplinary approach to historical records that document alterations in climate and responses to them in the past. The network builds on previous collaborations that CWEH has with Jawaharlal Nehru University, Kew Gardens, the British Library and The Met Office. These institutional and academic collaborations have allowed us to put together this meeting funded by the AHRC, which is seeking to understand climatic and environmental change in the Indian Ocean world. Why the Indian Ocean World? It is an area of primary geo-political importance, which includes the nations of East Africa, the Middle East, South East Asia, China and India; its economic, political and social foundations are related to the monsoon; the connections in the Indian Ocean World date back two millennia.

The period which we are focusing on, 1600-1900, saw a huge increase in long distance trade and voyaging leading to the exchange of commodities, people and ideas in the era of European empires. What I want to see visualised is India as the centre of that world, where it becomes a nodal point from which goods, ideas, people and institutions radiated outward. Richard Grove's work really did visualise India as the centre of the British empire which you can thus imagine slightly differently. European empires brought about an unprecedented ecological transformation in the Indian Ocean world, which was closely documented and remains traceable in various types of colonial and indigenous documents. These documents remain geographically dispersed, and one of the aims of the project is to bring together these disparate collections. Some of these documents have been studied in isolation but they have never been collected and researched for the network of socio-economic, literary and artistic information they contain.

Colonial records contain various papers and archives collected by individuals in colonial bureaucracies, naturalist, travellers, missionaries and scientific services. Physical sources include specimens of plants and animals and geological material which remain in herbaria and museum collections. We are particularly in the histories of botanical gardens and government departments dealing with natural resources, meteorology, geology, palaeontology, forestry, ornithology, fisheries and entomology in so far as they were concerned with environmental change and classification of the new world of empire.

Sources also include Jesuit records – which remain dispersed – along with imperial archives of the English, French, Dutch and Swedish Companies. Indigenous sources describing climate change are equally varied, including local gazetteers from the 15th onward; these contain records of crops, domestic and wild animals, as well as reports of unusual events such as epidemics and volcanoes. There are also literary and artistic accounts that provide rich evidence about climatic and environmental change. For example, The British Library archive holds a number of transcriptions from across India that lament the environmental change caused by the introduction of new crops. A large collection of Swahili poems holding similar information for the East Africa region is held at SOAS. Landscape and Wildlife painting has a long tradition in India and China, which provides information about the environment and human impacts on it.

For the purposes of this network we will concentrate on plant science, plant transfers and climate science of the Indian Ocean world. By conceptualising the integration of the documentary records, diaries, drawings, printed articles and books, correspondence, notebooks, log books with the physical evidence we aim to improve the research environment of the humanities, social sciences and natural sciences. One important way for the network to cross boundaries is by juxtaposing these different types of sources in order to generate data which is not only of value to scientific studies. The inclusion of social scientists and of humanities researchers, archivists and experts in digital technology within the network will enable the development of sources and methods to extract quantitative information from a range of sources while promoting qualitative approaches. The main aim of this meeting and of the next one in Delhi, is to map the range of sources available and to discuss how they can be utilised. The metadata aspects of the project are important in that the digital expertise of the network will allow us to mark up the historical data so that it can be mined for precise data about weather conditions or distributions of plants whilst retaining the richness of the material required for contextual studies. We hope to specifically engage with issues surrounding how scientists work with qualitative data and how a social sciences and humanities perspective can be integrated into climatological research. Pilot studies have already been conducted on the Indian correspondence of J.D. Hooker and the Nathaniel Wallich project, which Antonia Moon and Penny (Brook), will talk about later. Those will help to clarify issues relating to the larger project.

Today we have keynote speakers discussing research questions within the disciplines covered, followed by presentations on material and archival holdings. The afternoon will include an introduction to the technical problems associated with the project. Kate Showers will talk on data quality and data issues. The second day will focus on small group questions in order to develop collaborative ideas and potential digitisation projects, we encourage the development of counter intuitive collaborative opportunities and abnormal conjunctions, these will be included in a report compiled after the meeting which will focus on identifying popular clusters and nodes.

Session 1

Panel discussion; Plant science and climate reconstruction research questions

Chaired by Jim Livsey (Sussex), with Henry Noltie (Sussex), Steffen Vogt (Freiburg) and Rob Allan (ACRE).

Rob Allan Spoke about ACRE (Atmospheric Circulation Reconstructions over the Earth), the climate science project he heads and how that project has worked and is working in the Indian Ocean World. ACRE is primarily concerned with the collection of instrumental data, surface, terrestrial and marine weather observations worldwide over the last 200 years, its digitisation and the bringing together of various related projects and initiatives. This has traditionally involved experts looking at archival data, often ships log books. However, recently, moves have been made toward developing the potential of crowd sourcing 'citizen scientists' in order to execute the labour intensive process of digitisation and presentation of sources in international repositories and improving the quality, quantity and range of those data. ACRE works toward creating climate simulations on six hourly resolution going well back into the C19th, these simulations are the end product of the ARCE project, the presentation of data to users is of key concern.

ACRE acts to channel the work of projects from multiple regions such as the Arctic, Chile, the southern ocean and particularly the Indian Ocean, Africa and South East Asia. The value of ACRE's work has been recognised by various UN bodies but as yet no funding has been forthcoming from such sources. ACRE is in the process of building a network of associations within the Indian Ocean region notably in Mauritius and Sri Lanka as well as main land India via the Indian met office in order to recover more data from that region. In Africa ACRE is working with DfID (Department for International Development) as well as aid groups and in S.E. Asia. ACRE is working with the Singapore Met Service and the Royal Society's S. E. Asian Rainfall Research project in order to improve data retrieval in that region.

Steffen Vogt spoke on mixed method historical climatology, mainly non-instrumental climatology and the reconstruction of climate via such sources, the study of impacts of climate extremes on society and the discourse in social representation of climate in historical perspective. His work concentrates on written records but also utilises material records, interview and even oral histories of climate events. He employs methodologies such as critical source analysis from the humanities whilst incorporating statistical records and numerical analyses from the sciences. The primary work of the historical climatologist is in translating textual sources into quantifiable data ready for numerical analysis. By integrating source types, diaries, chronicles etc. and extending data by extrapolation through known geographical climatic variation models, reconstructions become conceivable over enormous areas. Such projects have been conducted in various regions such as Europe, the Middle East, India and S.E. Asia. In Indian Ocean regions data has primarily come from missionary records. The potential for data retrieval from records of the Moghul Empire is highlighted.

The TAMBORA project, which has received National Research Council funding, has been developed in partnership between the Leipzig institute and the Freiburg University library and Geography department to create a collaborative environment for historical climatologists in order to facilitate the process of accessing, transcribing and publishing data. The project works to build a database of searchable and cross-referencable digitised material of great value to both scientists and those working in the humanities as well as a workspace particularly tailored to the historical climatologist. Such a space, it is observed, could be very useful for collating data on monsoon variation.

Henry Noltie spoke on plants, botany and imperial knowledge transfer within the Indian Ocean World. He noted the importance of the Hookers and of Kew in the study of such an area before continuing to discuss how his own work related to the themes of the conference. On this he described how herbarium sheets, held in huge numbers by botanic gardens around the world could be mined for new information on numerous subjects including climate, plant dispersion, itineraries of voyages and personal biographies of voyagers and explorers. He went on to describe how botanical, art historical and biographical approaches to the study of botanical drawings revealed these too as rich repositories of historical, cultural and linguistic as well as botanical information. Such an approach was applied to set of drawings made for Alexander Gibson at the Royal Botanic Garden of the Bombay Presidency in the 1840s shedding significant light on his forest conservancy work but also on the importance of plant transfer within the imperial network, something approaching half of all specimens depicted were non-indigenous, it can be shown that these came from all over the world and from as far afield as California and Brazil and were distributed in part through the networks of botanic gardens.

A second project based on the enormous collections of specimens made by Robert White and held at the Edinburgh Botanic Garden enabled the reconstruction of a detailed scientific biography of White, the mapping of his collection areas and the understanding of his taxonomic techniques. White was involved in a large scale experiment in India, administered from England on the feasibility of growing American cotton in India and was secretary of the Madras Agricultural and Horticultural Society, part of a widespread and much understudied network of such imperial institutions. Noltie noted how the biographies of such figures and of those yet to be studied in such detail, particularly Hugh Cleghorn, Nathaniel Wallich, Lyle, William Griffith and Sir George Watt, research on the networks of agro-horticultural societies, including the digitisation of their extensive publications, the mapping in detail of the histories of botanic gardens such as Calcutta and digitisation of material held in state and botanic garden archives would represent a significant step toward achieving the stated aims of the conference. It is noted that continuing work on the building of image databases covering collections held at Kew, the V and A and Edinburgh Botanic Gardens is necessary in developing research in such areas.

Questions for the three speakers in section one raised issues surrounding scientist's traditional inability to use non-instrumental data and historian's inability to incorporate the precise calculation of errors achievable in the hard sciences. Rob Allan emphasised the importance of - and potential for - exploiting the overlap between instrumental and

more qualitative data and between various qualitative sources for extending understanding of climate history.

Session 2

Alan Lester (Sussex), Paramjit Singh (Botanical Survey of India)

The second session began with a keynote address by Prof. Alan Lester who spoke on the implications of the re-conceptualisation of the Indian Ocean World as the centre of the British Empire. By concentrating on networks of trade and knowledge transfer Lester outlined how in recent years historians of empire have begun to recognise the importance of geographical concerns and to break down the traditionally engrained state boundaries of historical research. Issues of space and scale have become as important as those of chronology, setting geographical and temporal causalities on an even footing and helped to break down conventional conceptions of the flow of modernity from the imperial core to the colonial periphery and building a new, dialectical model characterised by increasingly porous state borders. In this vein Catherine Hall's work on the colonial relationship between Britain and Jamaica and its importance in the history of both islands is seen as particularly ground breaking. The 'New Imperial History' to which Hall contributed is seen as self-consciously political, concerned with deconstructing ideas of the imperial and the colonial in the past, in order to re-conceptualise race in the present. The 'green imperialism' of Richard Grove and others is seen as carrying this revisionist spirit into the earlier colonial period, incorporating climate, pathogens and other non human actors and building an understanding of empire as a global, interconnected network rather than a simple polarity of imperial master and colonial slave.

Focussing on the Indian Ocean World and on networks in that area has developed understanding of the importance of particular nodal points, be they people, towns or institutions and the transfer of material and ideas between them. Actor-network theory has been developed to help work within this new paradigm and has been shown, by James Beattie in particular, to be useful in studying botanical exchange. The concept of 'imperial careering' has helped to show how the movement of individuals throughout imperial networks and their accumulation of experience worked to spread knowledge by non-linear routes. The importance of recognising and working to remove the elite bias of imperial sources is highlighted as of particular importance, it is observed that the experience of those subaltern groups; indigenous populations, European and colonial slaves, convicts and under-classes of all nations is particularly hard to reconstruct in such histories despite their importance in such networks. The potential of the project to add non-human considerations but also to flesh out the existing human picture, particularly in terms of the agency of indigenous populations is emphasised, as is the importance of networks in defining the Indian Ocean as a frame of reference. Looking to the future Lester notes how digitisation of sources is key to allowing the relatively immobile scholar to escape a national frame of reference and in building integrated historiographies.

Questions for Prof. Lester from Prof. Kumar highlighted the transience and dynamic nature of any conception of the imperial core, the importance of appreciating the socially constructed nature of scale within imperial systems and how imperial power must be understood to reside in geographically mobile nodes within the imperial network rather than to radiate from that core. James Fairhead introduced the idea of combative networks such as those developed by Indian Ocean pirates, disease and animal movement and the ways in which networks can be subverted and even used against imperial interests as in the case of anti-slavery protests and cross Atlantic routes.

Dr Singh began by giving a detailed history of the Calcutta Botanic gardens and of the Botanic Survey of India. Continuing, he outlined the range of materials available in India, relevant to the project, which include, in addition to the archives of some of S.E. Asia's oldest botanic gardens, significant collections and data on distribution of a huge range of fauna from various periods up to the present, offering opportunities for plotting environmental change. He went on to discuss the original economic and medical drives for collection and exchange of plants and of the importance of understanding the nature of plant collection and description which was in the first instance done primarily by indigenous artists and experts in the employ of European botanists. On the subject of sources it is noted that many pre-independence works by Indian experts are extant only in European herbaria, notably Kew and Edinburgh. The significance of the Calcutta Botanic Garden – its founder Robert Kyd and his successor William Roxburgh, the length of its heritage, and their significance in the founding of the Botanical Survey of India and in Botany in India as a whole – was emphasised. The work and collections of William Griffith, the many volumes of Roxburgh's work and the correspondence of Roxburgh and Wallich as well as Wallich's own collections and catalogue were highlighted as of particular significance to the project. At present it is observed, Indian herbaria hold in the region of 3m examples from throughout S.E. Asia, Africa and America, stored at various facilities. Modern collections are stored in humidity-controlled environments, however, old samples have not been so well looked after and require some restoration. It is noted how lack of access to the work of Joseph Hooker and other British surveys of Indian flora has traditionally held back Indian botany and how this network is working toward the removal of such hindrances. Access to Hooker collections is seen as particularly important as they represent an opportunity to assess changes in fauna in the most climate sensitive area, the Himalayas. Projects to create a linked network of digital Indian herbaria as well as the internet based; 'Indian Virtual Herbaria' are planned to open up the Indian archives to academics around the world.

Session 3

Panel Discussion; Archive Collections in the UK and Digitisation Thereof.

Penny Brooke and Antonia Moon (British Library), Jenny Wong and Zara Naghizadeh (Natural History Museum).

Penny Brooke discussed the British Library's collections relevant to the Indian Ocean region which to a great extent stem from the formation of the East India Company Library, taken over by the India Office in 1857 and ending with independence in 1947. The collection is extremely rich in both European and indigenous languages, totalling some 9 miles of records including 3,500 collections of private papers. The British Library has an agreement with the AHRC to work on joint initiatives with Indian institutions, over a million catalogue records have been placed online allowing people to plan visits in advance, in the region of 30,000 images are now available online, plans to digitise further materials to allow for remote access are in place. Further projects are under way working to reunite separated sections of manuscripts and archives often split between various locations in the UK and India, it is seen as being of great importance to determine the contents of the vast Indian archives. Databases of India Office and other archive documentation has been collated by associates at the Open University, tag clouds are highlighted as a particularly effective way of depicting networks apparent in such documentation. Collaboration is seen as important for a number of reasons including the pooling of resources and skills, particularly in order to develop the huge quantities of S.E. Asian language material held in the British Library archives.

Antonia Moon spoke in more detail on the contents and digitisation of India Office records, particularly those used in the Kew affiliated Wallich project which include botanical drawings, plant specimens and archives, and has been presented through the Kew website. Issues of interoperability, searching across types of sources, resolved successfully in the case of the Wallich project were raised, further, the importance of development of strong meta data to facilitate such ease of use was recommended as is the surveying and pre-selection of data for digitisation in order to ensure the most effective application of time and resources, which in the case of the India Office Records was determined by as joint project undertaken with SOAS in 2003. New projects are underway relating to medicinal and edible plants, utilising material held in botanical garden archives in India, mainly but not exclusively Calcutta. Importantly it is noted that all digitised material is available to all, free of charge, through the British Library website. Attention is brought to the seemingly underused European library website which acts as an aggregator giving access to 21m catalogued items and, increasing visibility of resources.

Zara Naghizadeh of the National History Museum (NHM) spoke on the subject of the digitisation projects underway at that institution including the digital repatriation of the collections of Sir Hans Sloane. Projects include the digitisation of the herbaria of Paul Herman and Hans Sloane. The Paul Herman herbaria are of particular historical importance in that they were used on numerous occasions by Linnaeus. The database is fully browsable and searchable; however, somewhere in the range of a quarter of examples are yet to be classified. Various other types of information are contained in the Herman herbarium, particular attention is brought to the presence of various insects pressed along with plants which provide evidence of biodiversity in collecting regions, it is also noted the among the drawings are some of ethnographic interest. The Sloane project is a joint venture with the British Museum and the British Library. Sloane's collection was remarkably various including objects of ethnographic interest, natural

history collections, books and manuscripts, art works and cultural artefacts. These have become dispersed according to type amongst the British Library, the British Museum and the Natural History Museum, the aim of the project is to digitally rebuild the Sloane collection so as to facilitate study of the collection as a cohesive whole. Some efforts are being made within the Natural History Museum to bring Sloane's collection together within that institution.

Jenny Wong, also of the NHM spoke about issues surrounding the display and exhibition of material, in particular relating to the *Images of Nature gallery* at the NHM which considers the different ways in which people have looked at and depicted nature over time. Methods for promoting lay interaction with sources were outlined, including the use of short films, collaboration with contemporary artists who are commissioned to make interpretive work based on material in the NHM archives, and relating historical sources to contemporary issues. Paintings from the Fleming collection, the Hardwicke collection, Wallich collection, the Sykes and Hodgeson collections and the Wyatt collection are included in the exhibition, there is a particular emphasis on recognising the contribution of indigenous artists as well as European collectors, in particular East India Company ship's surgeons. NHM archives hold East India company surveys of the Deccan containing pictorial records of flora, fauna, landscape, land use and agricultural techniques. The value of interdisciplinary approaches is highlighted by reference to a current collaboration with Indian artist Sunoj D whose work focusses on and seeks to subvert the clinical, ordered, 'unnatural' character of displays found in an institution such as the NHM which while being entirely concerned with nature contains not one living thing.

Questions in response to the speakers in this session revealed that the diaries of ornithologist A.O. Hume are also to be found within NHM archives. These predominantly pictorial records shed light on methodologies of scientists working in 19thC India. Only rarely does evidence of indigenous contributions go beyond the signing of illustrations.

Session 4

Panel discussion; Portuguese, Dutch, French and German Records

Chaired by Simon Pooley (Imperial). Speakers: Ana Paula Avalar (Portuguese Open University), Alicia Shrikker (Leiden) Kathleen Pribyl (Brighton)

Ana Paula Avalar presented on the subject of Portuguese sources relevant to the project. The Portuguese Empire was built up between the early C16th and C20th; letters from missionaries and ship's captains were sent back regularly from India to Portuguese centres describing meteorological conditions and monsoon variations, as well as the natural history encountered. These sources are yet to be explored and their value for such projects is still unknown, numerous texts were written in Portugal throughout the imperial period with a focus on natural history and biodiversity in India. Two significant

institutions were founded for the study of natural history in Portugal; the University of Coimbra and the Royal Botanic Garden near Lisbon, both of which attracted numerous European botanists during the C18th. However, the most significant resources for the present course of investigation are to be found at the *Instituto de Investigação Científica Tropical*, The Tropical Scientific Institute which holds the 'Oversees Historical Archive' containing pictorial materials as well as correspondence between C17th and 1975, concerning the Indian space. The National Archive, the Portuguese National Archive and the Coimbra General Library also hold similar materials but also iconographic and cartographic documents. The influence of other European centres on the type of work carried out in Portuguese institutions is substantiated but understanding of such questions lacks detail, research along such lines would help to extend understanding of knowledge exchange between imperial centres.

Alicia Schrikker described relevant work done on Dutch East India Company records and ship's logs such as an environmental history of Indonesia carried out by a group led by Peter Boomgard. Attention is drawn to the TANAP project which restores, digitises and integrates VOC and colonial period Dutch archives in Jakarta, Colombo, Chennai and Cape Town with those in the Hague. The project is accessible via the University of Leiden website, the databases are searchable yet, so far, predominantly in catalogue form only. The NHM in Leiden has recently become the central repository for botanical material in the Netherlands; these are predominantly drawings.

Kathleen Pribyl focussed attention on French and German archives relevant to the Indian Ocean region. For the French these are predominantly related to the islands of Madagascar, Reunion, Mauritius, the Mascarene Islands and the Seychelles. German records begin in the late C19th in East Africa, for both there are numerous records left by scientific bodies, missionary groups and individual travellers as well as national administrations. Instrumental data from ships and ports between the C17th and the late C19th is fairly consistent and accurate and is held in the French National Archive in Paris. A digitisation project at Exeter University, part of ACRE is already under way utilising French Indian Ocean data. The French colonial archives contain governmental reports, meteorological and cartographic information. Jesuit missionary archives are seen as particularly significant because of the scientific training missionaries underwent. German, Protestant missionary archives, notably Hermannsburg, contain only qualitative data but do include interesting information on the social impacts of extreme events.

Questions in this section also raised the possibility of exploiting Dutch, Swedish and Danish archives relating to forestry, as well as the records of Norwegian Missionaries in South Africa and Madagascar. It was also noted that Spanish sources exist, including diaries, letters and early publications. These are, however, predominantly focussed on South America. The development of Indian language records is seen of primary importance.

Session 5

Panel Discussion; Technical Considerations

Chaired by George Adamson (Brighton). Speakers: Rob Iliffe (Sussex), Kate Showers (Sussex) and Anna Saltmarsh (Kew)

Rob Iliffe cautioned against needlessly restricting the ambition of the project at this early stage, particularly if that restriction is born of doubts surrounding data quality or abundance in pre-1600 sources, arguing that all data has some value as long as its limits could be understood. He described how the network should act as an umbrella organisation for numerous related projects both prospective and ongoing such as the Wallich, Hooker and various Sloane projects. Counter to Antonia Moon's earlier comments he described as preferential the digitisation and presentation of raw data, in the absence of sophisticated metadata as an important first step, so as to more quickly circumvent issues of scholarly immobility and thus broaden access to originals; metadata could be taken care of later and more easily once the number of experts able to access resources was so increased. A further advantage of such an approach is seen in the relative lack of expertise required at that enormously time consuming first stage, which, could potentially open up the use of crowd sourcing and citizen science in the process of data capture.

Kate Showers' talk raised issues of data quality, how data can become skewed or biased through instrumental or human error, subjectivity of observers, unsuitable or inappropriate extrapolation, poor choices of sample group or frequency and how unforeseen consequences can evade detection and therefore give an incomplete picture. In the African context it is noted that within the British administration, official figures were often estimates. Documents, pictures and reports all have to be analysed in great detail in order to get beyond the accumulated distortions of individual and institutional bias and subjectivity. On the subject of botanical sources special mention is given to the importance and difficulty of appreciating how plants act within the extremely complicated contexts of real world ecosystems rather than when isolated for scientific study. Further, the importance of recognising models and extrapolations as such is seen as key to retaining integrity of statistics based qualitative work. The example of the World Soil Map is used to highlight how even when the incompleteness of data sets is recognised and accompanies material, the very act of making too tenuous an extrapolation can open up the work to deliberate or inadvertent misrepresentation. The GLASOD project assessing soil degradation, which was based entirely on unverified expert opinion, has been found to be generally inaccurate and yet it has and continues to be used widely as the basis for policy.

Anna Saltmarsh, is manager of the digital collections at the Kew herbarium. She described how digitisation of the Kew herbarium is seen as particularly important for academics and researchers because of the numerous restrictions on access to specimens,

many of which are born of the necessity of keeping the herbarium pest free. The herbarium contains some 7-8m specimens including various private collections such as those of William Hooker and George Bentham. Kew's herbarium is known for its broad taxonomic and geographic scope, it is thought to contain examples of 98% of genera. Digitisation is, in the first instance, a process of photographing samples, some 580k specimens, equating to an estimated 8% of the collection, are currently digitised and are available through herbarium's online catalogue. The digital herbarium also operates as part of the much wider Global Biodiversity Information Facility (GBIF). The GBIF data portal gives access to some 321m specimens and is recommended as the best point of access for digitised Kew collections. The Global Plants Initiative, which began as the African Plants Initiative is currently the main digitisation project at Kew, which involves around 250 contributing institutions whose material is accessible through JSTOR Plant Science, full resolution photographs of samples are available through this site only. Director's correspondence from the mid C19th have also recently become available, further, it is noted that most of Kew's digital media is also available through the European library, a project here is under way to allow specimens to be searched via vernacular names.

The questions in this session raised issues around crowd sourcing. It was noted that in the case of numerical data, errors were easily removed by having the same data repeat processed and then checked for outlying points. Anna Saltmarsh commented on the potential of using amateur naturalists to process material, data from which is then checked for errors by botanical experts. A similar approach is planned in the NHM's Sloane project.

Day Two

Session 6

Methodologies and Pitfalls in Environmental History

To begin day two Mark Elvin (ANU) spoke of the difficulty of comprehending the mindset of the early colonial botanist and sought to point out some of the most significant differences between the C17th and C21st gaze. By way of example he discussed the work of the great Italian naturalist and draughtsman Marcello Malpighi, who whilst making the most remarkable botanical drawings remained totally ignorant as to the function of the various aspects of plant anatomy, he held that plants reproduced when the bud formed, fell off and then regrew. Creationist explanations were also widespread, many believed that a plant contained a finite number of minute versions of itself which would spread and grow, but that would eventually run out. Peter Lauremberg's eminently practical *Horticultura* which was in the main concerned with the every day of growing plants, drainage and which varieties did best in what soil, states that 'sex between plants is the most ... unthinkable nonsense'. Though Lauemberg's work treats the plant by analogy to the human body, the leaves to the hair, flowering as analogous to female menstruation, in sexual terms the two are seen as entirely distinct. Lauremberg argues that generation in a

plant is achieved in the absence of conjunction with another plant, the primary reason being that plants cannot move. The appreciation of the importance of this pre-Linnaean but also distinctly pre-Darwinian gaze, its influence on the sources from this period and how we, as modern academics should read them is seen as key to the proper understanding of such a time and place. It is proposed that a reconstruction of the indigenous gaze may also be possible through the study of non-European language sources.

In Questions James Fairhead discussed the example of the *figus* or fig tree which fruits without flowering and thus breaks with the female menstruation analogy. It is noted that the same tradition of explanation by analogy to the human body also held sway in some African cultures, here, the production of the fruit before the flower was held to mean that all figs must be twins, this tree consequently became associated with twin culture. Such examples are seen to disrupt the idea of linear, European intellectual development, suggesting that indigenous knowledge and theories actually informed European thinkers. Vinita Damodaran suggested the involvement of experts on pre-colonial Indian botany in the next conference in Delhi. Kate Showers commented on the importance, when treating ancient European and indigenous sources, of appreciating the flexibility of vocabulary, that such sources have to be translated not just between languages, but between ways of seeing and of describing things, and that such an appreciation can reveal truths which were originally hidden by our own C21st ways of reading sources.

Session 7

Panel Discussion; Research Methodologies within the Indian Ocean Region

Chaired by Kate Showers (Sussex). Speakers: Andrea Janku (SOAS), Jeyamalar Kathirithamby-Wells (Cambridge)

Andrea Janku gave details on sources for early-modern China which are mostly local histories, most notably the extremely rich 'Chronologies of Auspicious and Inauspicious Events' covering, among other things: natural disasters, earthquakes, astronomical events, good and bad harvests. She also described archives of paintings and drawings which depict famines in China, showing people eating roots and bark and in some cases whole families hanging themselves to avoid starving. Such illustrations were presented to the emperor in an attempt to prompt a reaction to the famine. The main issue with such sources is that they are official, they were created for the emperor, however it is observed that triangulation of sources, from different bureaucratic levels and regions can help to confirm or disconfirm details. Collections of maps and 500yrs of rainfall data also exist but are of unknown accuracy. A further source is biographies of charitable people who extended help during famines and as such recorded these events and their severity. The Ching archives hold information on grain prices from C18th onward, a database of which has been compiled.

Jeyamalar Kathirithamby-Wells discussed how environmental history has worked to breakdown traditional periodisation of early modern, modern, colonial and post-colonial.

In terms of methodologies a focus on 'dominant themes', particularly maritime trade in this case is seen as productive and well suited to such international study. Transplantation of crops, most notably of Malabar Pepper into S.E. Asia is seen as of particular environmental significance, the development and subsequent abandonment of plantations when soils became exhausted led to the creation of extensive grasslands in Sumatra, Borneo and Thailand which were suitable for herbivores such as deer and elephants. Traveller records have been useful here. Crops were also introduced by the Spanish, notably maize and the potato, which, because of their higher yield per acre, opened up land for cash crops such as tea. Cash cropping was disastrous for forests and led to great increases in flooding; in this regard colonial records can help to explain changes in biodiversity, the impacts of forest degradation and of fires and how these were countered. During the early period droughts were not linked to El Nino or ENSO variations, however in retrospect these considerations can be very informative and can reveal indigenous understanding, drought planning and contingencies. A particular theme suggested for further research is the movement of rice and other grains as an indicator of food shortages and famine.

In the question session, Kate Showers pointed out that work on rice movement in Vietnam has been published and may provide an interesting model. Furthermore, after years of famine study in S.E. Asia, it may be time for environmental history to expand into the study of agriculture and indigenous practices.

Session 8

Panel Discussion; Research Methodologies in the Indian Ocean Region – Part 2

Chaired by George Adamson (Brighton). Speakers: Vanessa Winchester (Oxford), Dave Nash (Brighton), Paul Lane (York), James Fairhead (Sussex).

Vanessa Winchester, a dendrochronologist, described her work on the Berenty Reserve in Madagascar. She explained how the study of tree ring data enabled the study of climate change, also it is noted that valley cross-sections can be decoded to write histories of the levels and paths of rivers over geological time frames. The region is vulnerable to cyclones, experiencing a large event every 7-10 years, the consequent floods are recorded with good precision in the tree ring data collected at the Berenty reserve. El Nino years are not visible in the tree ring record.

David Nash spoke on historical climatology in Madagascar and East Africa, and mixed methodology climate research, concentrating on El Nino variation and societal effects thereof. He described the incredibly rich resources to be found in Britain at The National Archive, The British Library and SOAS. Botanical diaries are available at Kew and Rhodes House in Oxford, large collections of missionary reports at Rhodes House and Edinburgh, often Quaker missionaries in Madagascar, Norwegian and Mauritian National archives have also been consulted. The EuroClimHist database is recommended as providing a good model for organising and processing climate data, it is noted that

missionary sources are particularly good at recording impacts on people, also that different societies in different contexts had different linkages to the land. For example the London Missionary Society, normally very good at recording day-to-day weather, in Madagascar lived with the royal family and therefore were fed or bought food; the significance of the weather in their lives was thus dramatically reduced and records suffered as a result. Nonetheless extreme events, cyclones in particular are well recorded, by taking descriptions of damage and comparing such reports with modern events and by cross-referencing between different missionary stations it has been possible to reconstruct the life cycle, the development, strength and path of the cyclone in modern terms (see papers by E.R. Boose and Mike Chenoweth). The NOAA storm tracker database, which now reaches back to 1842, is also mentioned as a rich resource for the study of tropical storms.

Paul Lane spoke on the types of data archaeological techniques might make available to environmental historians and historians of climate, these include charcoals, fungal spores and various archaeo-botanical materials, including plant materials which either pre-existed or were introduced into sites by human agents. Proxy indicators of climatic conditions can also be of great value; dramatic advances have been made in recent years in the use of radiogenic isotopes found in animal bones to reconstruct the climate and vegetation profile of a particular time and place, estimates of humidity can be made from the relative balances of nitrogen and oxygen found within bone samples. Archaeology's main contribution can be in adding understanding of longer term climate oscillations, many of which take place on much greater time scales than for which instrumental or even human derived records exist.

James Fairhead criticised the focus on the transfer of plants via institutional networks stating that maize, squash and peaches were all introduced into New Britain (Papua New Guinea) by essentially private routes, that is, in an unofficial capacity by a ship's captain, and further that ship's captains and other individuals transported significant private collections and so created unofficial, informal networks of plant and knowledge exchange very likely invisible to researchers at the current time. In terms of human-environmental interactions it is noted that a very many indigenous practices are yet to be studied, such as the transfer and cultivation of coral reefs, and that our ignorance in regard to such practices is rooted not only in our methods of looking into the past but also in our assumptions about what constitutes a 'cultivated' or a 'natural' environment. In relation to archives it is noted that these do not exist only in libraries and institutions but that forests and landscapes also constitute archives, one simply needs to understand the language in which they are written, that is the human techniques which helped to shape and construct them. The inadvertent transfer of ants, termites and leeches is also noted as of significance, leeches are known to transform human relations with forests, redefining them as seasonal resources. In S.E. Africa it is observed that only some forests have leeches, it can therefore be proffered that these animals have a transport history; underground histories of these types are yet to be told. Finally it is cautioned, in relation to the study of indigenous practices, not to westernise such practices through study; a holistic approach must be taken to ensure that indigenous traditions which are often multifaceted are fully understood, so that, for example, the medicinal plant is not

understood only for its chemical properties but for the human culture and ritual which is associated with it.

Questions raised issues surrounding the use of fire in creating East African landscapes. The collection of further fire data is seen as key to resolving increasingly bitter debates which have developed over the role of fire in the Madagascan landscape and the extent to which the current form of that landscape is a result of human influence.

Session 9

Deepak Kumar (Jawaharlal Nehru), Richard Gartner (Kings)

Deepak Kumar's keynote speech brought attention to the huge variety of pre-colonial Indian sources which have often been overlooked by academics; he went on to encourage not only the recognition of indigenous contributions but the investigation and identification of specific, named contributors and the reconstruction of their biographies. The exploitation of local, indigenous language sources and skills are seen as key to this project. His speech sees arguments over emphasis in imperial studies between the Eurocentric, expansionist models and revisionist paradigms concentrating on indigenous knowledge as essentially over, these discussions he states laid the ground work for dispassionate histories of colonialism which rightly recognise the dialectical nature of empire, network models which seek to build nuanced pictures of information and knowledge exchange which worked to build what can now be considered as collaborative, decentered knowledge systems. On epistemological issues Prof. Kumar described the importance of recognising all truths as partial and the importance of admitting the impossibility of reconstructing the colonial encounter from the relatively minute evidence which survives, but, on a positive note, that dramatic improvements in the academic environment in India have been made. The richness of historical records in India yet to be given due attention are noted and fuller engagement of western academics with such resources is encouraged.

Questions to professor Kumar raised the likelihood of finding valuable information on biodiversity within missionary records and in records held in the Vatican. It is noted that Jesuit records have been studied predominantly for their astronomical, educational and medical content, agricultural, ecological, botanical and natural historical material having received far less attention.

Richard Gartner is a lecturer in Library and Information Science with a particular interest in the use of XML (Extensible Mark-up Language) to construct searchable virtual archives. Here he spoke on the subject of the digital combination of resources toward building an overarching 'Super Resource'. The use of common metadata language across resource types – and thus across all network affiliated projects – is key to achieving this interoperability and to allowing users of the final system to attain meaningful results when searching across enormous quantities of diverse material such as botanical specimens, drawings, correspondence, log books, weather records, diaries and manuscripts. Projects such as Cendari and the Demonstration Test Catchment Archive are

seen as having made significant advances in metadata handling and in integrating various sources. One of the main advantages of XML is its durability, it is considered the most 'archivally robust' form of information handling, it is not restricted to one particular platform or software and so information thus encoded should be usable long into the future.

Questions here revealed some concerns over the possibility of making data temporally, as well as geographically, searchable and of making sure that data do not become divorced from their original context, which would open them to misrepresentation or misinterpretation. Both issues are seen as easily surmountable, with precedence in existing systems. The digitised Kew herbarium and Hooker and Wallich projects were identified as prime targets for integration at the first stage; the construction of linkages to translate equivalent terms across projects is not seen as a significant technical challenge.

Session 10

Round Table Discussions

The focus of these discussions was to build up the concept of the Indian Ocean world as a geographical entity through consideration of formal and informal networks of exchange and climatic interconnectedness. Vinita Damodaran appealed to scientists and those from the humanities to work together towards breaking down the traditional divide between the disciplines, to write histories founded on strong ecological data, and to build new cultural-scientific understanding which incorporates indigenous, gendered, and subaltern perspectives from different, source materials and knowledge systems. The specific goal of the discussions was the identification of resources to be considered for digitisation.

The themes identified within the table discussions were as follows:

Historical Climatology

Chair: George Adamson

1. Need to identify research areas that are worth knowing about and for which sufficient material is available.
2. An opportunity exists for comparative studies between regions on either side of dipoles within the Indian Ocean world. A meta-project incorporating climate reconstructions through the Asian monsoon region would be extremely useful.
3. There is a need to coordinate material existing in different languages, and to avoid a bias towards English- and German-language sources. Rob Allan agreed to put members of the panel in touch with scholars at Meteo France. He also mentioned an existing MoU between the Met Office and China.
4. An Indian-Ocean wide database of climatic information dating back 500 years would be very useful. Linking existing databases would be a start.
5. Small archives would have a difficulty in access, and possibly copyright. Small-scale digitisation by individuals visiting archives as part of scholarly study would be difficult, but it would be possible to 'piggy-back' digitisation projects onto

- other projects. One possibility would be for individuals visiting an archive to flag-up the existence of other useful material for the use by other scholars. Digitisation of microfilm would be easier.
6. It was suggested that the project could be a facilitator rather than a top-down organised project, in the vein of ACRE.

Land Use

Chair- Mark Elvin

1. Wide-ranging topic covers, institutions, crops, botanic gardens, polity and culture sciences like entomology, microbiology.
2. To focus on what is already there and what is the best question that could be asked of the material
3. Problems of miscataloging need to be identified with regard to source material and creating a bibliography were emphasised as a first step

Botanical and Colonial Networks

Chair: Vinita Damodaran

1. Interesting projects include (a) gardening history of the IOW. Looking at the local gardening practices, including imperial Mughal gardens, and more subaltern gardening practices such as women's, gardening practices, subaltern botany and knowledge exchange, local practices of horticulture(b) visual representation and artistic formulation in photography, literature and links between different empires. (c) country shipping and shipping lines between Sofala, Dares Salaam, Portugal. Cargos of Arab Dhows and what they carried, plant transfers. The history of the mango a good project. Point made that most plants are not indigenous. Look at endemic and alien species
2. A variety of under-consulted sources include: (a) Macmillan's tropical garden book on ornamental trees, used in both Sri Lanka and Malawi; (b) agri-horticultural societies papers;(c) Indian gardening magazine, (d) Nyasaland agricultural and forest magazine, (e) and taxation records.
3. Botanical archaeology and historic herbariums are another good source for *materia medica*
4. Archives inventory: Maputo archives suggested.
5. Check existing digitisation of VOC records
6. Indian collaborators to include, BSI and JNU
7. Need to summarise data in different languages with an attractive presentation

Institutions

Chair: Deepak Kumar

1. Institutions will need a Memorandum of Cooperation or MoU, on the platform 'World Flora Online' to be coordinated by the Centre for World Environmental History, University of Sussex.
2. Institutional operability needs to be explored by the stakeholders for the data

- management and storage of new data, wherever possible.
3. This may require a strong managerial group stationed at Sussex.
 4. There is a need to create a research environment accessible globally in terms of the data generated.

India 1

Chair: Vinita Damodaran

1. Projects inter-disciplinary, proxy climate data, time series of phenological information in the Western Ghats, environmental history of India, changes in land-use and forest history, canopy definition.
2. Sources include temperature and precipitation records from colonial Botanic gardens, pre-colonial gardens including Mughal gardens whose sources include Ain i Akbari, Persian records of horticulture, Mahratta records
3. Digitising: a) Need to list the material already known to us and digitised. b) Digitising the Hooker herbarium. c) Sloane's five volume on the Malabar coast as a possible digital project. d) Citizen science projects as a way to digitise further.
4. Collaboration in terms of manpower and integrating sources as a key to collaborative digital effort. Wallich project is a good example as it incorporates herbarium, letters and paintings
5. Users of this material to include ordinary people including gardeners, journalists and so on.
6. Public engagement aided by networking between institutions and MOUs between them, online exhibitions, educational leaflets. Citizen science with an online archive facilitating public engagement

India II

Chair: Deepak Kumar

1. The project needs to:
 - a. Take advantage of the language expertise (e.g. Sanskrit, Persian, Tamil) of the National Manuscript Mission in Delhi.
 - b. Undertake a content analysis of the archives resources in South Asia in terms of the botanical and meteorological data.
2. The types of material to consider may also include images, photographs, maps, films, oral history and similar collections in institutions in India and abroad.

Africa

Chair Kate Showers

1. Need to see what other networks are doing with regard to IOW, and what their databases are?
2. A list of potentially interesting archives can be constructed by contacting researchers familiar with the different geographical locations. Then coarse-grained survey of these archives should be made – perhaps by the researchers already familiar with them. However, this work should be paid, not voluntary.

3. Pre-colonial sources need to be identified.
4. Input needed from historical linguistics and oral history, as well as archaeology, to understand the IOW world
5. Clear definition of what constitutes IOW is needed, since coastal networks of influence, exchange and trade extended inland as well as out to sea.
6. Important to engage local scholars and institutions, not only so that their work is recognized, but also to provide access to non-European language and cultural sources of information, and ensure that all coasts of the Indian Ocean are fully included in the network. Additionally, local inclusion in data collection and interpretation will ensure the possibility that resulting analyses will be perceived as useful for local policy making and implementation.
7. Influences of the African continent on Indian and the Indian Ocean world should be acknowledged more concretely. This was not a one-way exchange, and has been a neglected area of study.

Southeast and East Asia

Chair Mark Elvin and Jeyamalar Wells

1. Records of trade between India, China and South East Asia an important source
2. VOC records have been digitised quite extensively
3. Portuguese records for example relating to the Manila Acapulco trade need to be identified
4. We also need to have a list of what has been digitised so far in terms of these archives

The next network meeting takes place in Delhi on August 30 and 31st 2013.