



samara

The International Newsletter of the Partners of the Millennium Seed Bank Project

Knowledge sharing: the Millennium Seed Bank training programme

The immediate priority of the Millennium Seed Bank project (MSBp) training programme is to build partners' capacity to collect and conserve high quality accessions of dryland species. Typically, MSB partners have experience in herbarium taxonomy or in collection and conservation of crop plants. The training programme aims to combine this knowledge with the MSBp staff's seed conservation experience to develop the specialised skills and knowledge needed to collect and conserve seeds of wild species.

Training is provided in a variety of ways including in-country training courses, joint collecting missions, informal technical training at the Wellcome Trust Millennium Building (WTMB), or focused in-country workshops on key topics.

Michael Meso of the Kenyan Forestry Research Institute (KEFRI), Joseph Kamau of the Kenya Agricultural Research Institute (KARI), and Mathias Muindi of the National Museums of Kenya (NMK) are all working in the Kenya Seeds for Life (SFL) project. They spent four weeks receiving on-the-job training at the MSB, processing and testing Kenyan seed collections, and are now incorporating the skills acquired into routine seed testing and processing at their respective institutes.

Adelaida Ocampo, responsible for the seed bank at the Mexican National Autonomous



Adelaida Ocampo collecting in Tehuacan Valley.

University (UNAM), recently spent two weeks at the MSB as part of the collaborative research and training programme, developed by the project, to conserve and study the seeds of wild species from arid and semi-arid regions of Mexico. (See box right)

Story continues on page 2

The Mexican project

The Mexican project to conserve the seeds of wild species from arid and semi-arid regions of Mexico, especially those that are endemic or endangered, grew out of the successful small-scale collaboration between UNAM and RBG Kew, dating back to 1993, and involving staff from both organizations in collecting, training, and study of seeds and associated herbarium specimens from the Tehuacan-Cuicatlan Valley.

Adelaida Ocampo was one of the participants in the nine day training workshop "Methods and techniques for the conservation and use of Mexican arid zones germplasm" held in Mexico in September 2000.

Her subsequent experience of processing the seeds collected from Tehuacan-Cuicatlan Valley showed that:

- some species presented storage and viability problems
- other species had dormancy problems
- Further investigation was needed on seed survival at lower moisture contents and optimum temperatures for seed germination.

Story continues on page 2

As well as this foundation training, the project is also helping to meet partners' wider conservation training needs. In 2001, John Kennedy Kiamba from KEFRI, Itambo Malombe from NMK, and Esau Oginga Omollo from the Kenya Forest Department (FD) undertook Kew's eight week International Diploma in Plant Conservation Techniques (PCT). (*See below*)

In the longer term, the MSBp training

programme seeks wider impact and sustainability by supporting national and regional training initiatives. Patrick Muthoka from NMK and William Omondi from KEFRI have both completed research attachments at the MSB, and are now contributing to the development of a new diploma course in Plant Genetic Resources Utilization and Conservation at Maseno University, Kenya.

Seeds For Life personnel attend Plant Conservation Techniques course

Esau Oginga Omollo, Senior Conservator of Forests in the FD, is jointly responsible for identifying and considering the current status and potential benefit of on-farm utilisation of indigenous plants within the Seeds For Life (SFL) project. This is a key activity, linking the collecting and research activities of the project to the need to improve the livelihoods of rural communities. Esau's PCT project examined the many ways in which indigenous plants contribute to the livelihoods of the West Pokot people (from the North West of the Rift Valley province, Kenya) and outlined a draft project proposal for involving local people in wild plant conservation. This proposal will form the basis for increased work with local communities in a future phase of the SFL project. Esau was encouraged by the fact that the course was "focused on resolving real global conservation problems" and was run by staff working "on a daily basis on resolving conservation problems".

Itambo Malombe is a Research Scientist at NMK, responsible for the task of generating target species lists for the SFL project. Malombe's PCT project "*Prioritising species from drylands of Kenya for ex situ conservation*" was a first step towards developing a list of priority species which will be used

to guide the overall collecting programme. His work highlighted information gaps in existing databases and he will now work to update these databases and refine the methodology to better incorporate the socio-economic value of dryland species into the priority setting process. The project also used vegetation predictive maps and satellite imagery data maps in order to identify areas of high species density, and areas of natural vegetation, which will help in planning future collecting trips. Malombe highlighted the "knowledge and contact" received during the PCT course as a key benefit.

John Kennedy Kiamba, an Assistant Research Officer at KEFRI, participates in seed collection and seed research activities, and will play a key role in incorporating the use of x-ray facilities in assessing the quality of seed accessions banked by the SFL project. Previously, X-ray analysis was only carried out at Kew but KEFRI will now routinely provide this information, which will enable quicker decision making as to whether to bank a particular seedlot or to make a repeat collection. John's PCT project compared X-ray data obtained at KEFRI with that generated at Kew. He also drafted a Standard Operating Procedure (SOP) for the X-ray examination of seeds at KEFRI.



Esau Omollo, Itambo Malombe and John Kiamba receive their PCT Diplomas from Peter Crane, Director of the Royal Botanic Gardens, Kew, in the presence of Stella Simiyu of the National Museums of Kenya.

The Mexican project

Adelaida's attempts to overcome these problems were complicated by the fact that many of the 'problem' species had no comprehensive storage or viability records.

During her visit to the MSBp, she attended the Kew International Conference "Seed Conservation: Turning Science into Practice" and then spent time in the WTMB laboratories, working alongside Seed Conservation Department (SCD) staff and receiving a mix of formal and informal training on:

- seed viability theory, germination temperature treatments (alternating temperatures), and surgical techniques to break seed dormancy with Robin Probert
- viability testing with FDA with William Omondi and Chris Wood
- seed processing, seed structure and X-ray analysis with Janet Terry and James Wood
- collecting methods, planning, targeting and data management with Michael Way

Adelaida had brought with her seeds of some of the 'problem' species, mainly from the Burseraceae, Convolvulaceae, Celastraceae, Solanaceae and Leguminosae families, and these collections were used in the demonstrations and practical training. As a result of discussions with Robin Probert and Natasha Ali, Adelaida has now been able to successfully germinate seeds of *Bursera sp.*, using a simple surgical technique to break the hard seed coat.



Seed conservation: Turning science into practice



Attendees of the Workshop outside the Wellcome Trust Millennium Building.

The practical aspects of seed conservation were the focus of an international workshop, which took place in July 2001 in the UK at the Wellcome Trust Millennium Building (WTMB), home of the Millennium Seed Bank project. 67 participants from 29 countries, including many actively involved with the project, attended the workshop.

The workshop had two key aims. These were, firstly, to establish a baseline of information on seed conservation at an early stage of the MSB project, by bringing together many relevant experts in seed conservation and, secondly, to turn this information into a handbook.

The 24 lectures fell within four session themes:

- **Office to field** (CBD issues, planning and targeting)
- **Field to store** (seed development, collecting, processing, drying and information handling)
- **In the store** (seed longevity, dormancy and germination)
- **Store to field** (regeneration, use of samples, links between *ex situ* and *in situ* conservation and genetic characterisation)

The more general reviews were strengthened by the inclusion of case studies. Further case studies were included within the poster session, where over 30 contributions were presented. Included within the workshop were a tour of the WTMB, a number of seed technology demonstrations and a tour (on the Sunday) of the sights of London (including a trip, sponsored by British Airways, on the British Airways London Eye).



Personal views of the Workshop

It was a great opportunity to participate in the workshop, as a collaborator with the Millennium Seed Bank project. Egypt signed an access and benefit sharing agreement with the MSBp in April 2000, because we are completely convinced of the mutual benefits of this agreement for both sides. The workshop was a great opportunity at the international level to meet with other participants of the project, many of whom I didn't know personally before the meeting in spite of working in the same field. The workshop presentations indicated revolutionary progress in seed collection and conservation technologies, such as GIS and remote sensing applications. It also highlighted the technological gap between different partners of the project and the need for frequent meetings between partners to close that gap.

Ismail Hussein

Desert Research Center, Egypt

From my point of view, this workshop was successful, particularly from the scientific angle. The sequential arrangement of topics was very effective in generating participation and performance. The participation of the various overseas counterparts (who presented both talks and posters) was very encouraging and convincing, especially for those who are at the stage of preliminary negotiations.

The attendance of many experts and specialists in the field of seed conservation, including representatives of international institutes such as IPGRI and CGIAR, gave added benefit to the workshop, since opportunity was made for discussion sessions.

The WTMB, where the workshop was held, is very impressive and comfortable. One can also see the building where the previous Seed Bank was housed, so as to make a good comparison between the high technology and the traditional one in terms of saving seeds. The raised parterres outside the WTMB symbolize the global diversity which is found inside in the Millennium Seed Bank.

Sabah Saifan

National Centre for Agricultural Research and Technology Transfer, Jordan

A selection of international programme activities

Chile

In Chile, the Instituto de Investigaciones Agropecuarias (INIA) has been working with Kew on the project *Ex situ conservation of endemic, vulnerable and endangered plant species from Desert and Mediterranean zones of Chile*. The project leader, Dr Pedro León, has been discussing with Chilean colleagues ways in which they can participate in the project, for example by contributing data, joining collecting missions and attending a seed conservation techniques training course to be held in March at INIA La Platina, Santiago.

The MSB Americas co-ordinator, Michael Way, will participate in a joint expedition to launch the collecting programme formally. Initially the collecting will concentrate on threatened geophytes and then attention will move to endangered tree and shrub species from central Chile. For these species, research is required into seed storage behaviour.

It is hoped that the project will receive a grant in 2002 to support GIS analysis of herbarium data from region III. This study, to be undertaken by Dr Lohengrin Cavieres at the Universidad de Concepción, will make use of the massive Flora of Chile database and will help to identify priority collecting areas. Collecting, joint research and a continuing training programme will be central to the project, which will seek additional academic partnerships throughout central and northern Chile as it develops.



Right: **Fruits of *Rhodophiala***
Far right: **Michael Way assessing seeds of *Adesmia* in the pea family.**



Left: **Collecting of *Pterocarpus erinaceus* Poiré and *Moringa oleifera* Lam.**

Egypt

Research at the Egyptian Ministry of Agriculture and Land Reclamation is divided into the “cultivated-species” research of the Agricultural Research Center and the “wild species” related work at the Desert Research Center (DRC). The DRC has departments for Plant Genetic Resources, Medicinal and Aromatic Plants, and Ecology and Range Management, as well as the “Egyptian Genebank for Desert Plants”. All this makes the DRC the obvious counterpart for the MSB. As a result, an Access and Benefit-Sharing Agreement between the MSB and the Desert Research Center was concluded in April 2000, paving the way for joint collecting, training opportunities, and possible research collaborations between the DRC and the MSBp.



Burkina Faso

In Burkina Faso, an Access and Benefit-Sharing Agreement was signed in September 2000, between the Millennium Seed Bank and the Centre National de Semences Forestières (CNSF) in Ouagadougou. This has paved the way for joint collecting, training and research opportunities. Collections resulting from earlier expeditions in 1998 and 1999 have been brought under the terms and conditions of the ABSA, while a third mission took place shortly after signing. As CNSF is a forestry institute, it was logical that the first missions concentrated on trees and shrubs. Impressive results have been achieved in these categories as CNSF has great experience



Above: **Personnel of CNSF cleaning seeds.**

in collecting from trees, even as tall as 20m. The third expedition focused more on annual “herbacées”, thus enriching the collections in new directions. All materials are pre-cleaned in Burkina Faso and divided equally between CNSF and Kew. Local expertise guarantees prompt identification in the field. Meanwhile, scientific relations have developed as well. The MSBp has hosted a scientist working on *Vitellaria paradoxa* (Gaertn.f.) and currently hosts another one, working on seed storage longevity of tropical tree species.

The first activity was a joint expedition in the Sinai desert in May 2000. Since then DRC staff have participated in Kew's Herbarium Techniques course, while another member of staff will work at Kew's Jodrell Laboratory during the first quarter of 2002.

Meanwhile a second expedition to the remote Gebel Elba region on the border of Egypt and Sudan took place during April-May 2001. Seed cleaning and plant identification take place on the spot and the collected seed material is divided equally between DRC and Kew.



Far left: Northern Sinai desert landscape.
Left: Collecting *Calligonum comosum* (L'Hent.) in Sinai.



Botswana

The Millennium Seed Bank project welcomes back Birgitta Farrington, who has recently taken on the role of Project Co-ordinator for Botswana, with the task of developing and helping to run a programme in that country. Birgitta formerly occupied the position of International Programme Officer at the Millennium Seed Bank but moved to Botswana at the beginning of the year.

Jordan

Around 70% of Jordan consists of stony steppe and desert. Rainfall and vegetation are limited, with only 30% of the landscape being of a more varied, "green", and inhabitable nature. This 30% is located to the west in a north-south oriented band in the country. In spite of all this, the flora contains some 2,100 species, including around 150 endemics. The biggest threats to this richness are drought and the rapid increase in population.

The National Centre for Agricultural Research and Technology Transfer (NCARTT) incorporates the national seed collections of Jordan. Until recently these had been orientated solely towards agricultural and horticultural crops and their wild relatives, although the Centre also houses the collections that Kew made with the University of Jordan in Amman in 1996. The Centre includes a Genetic Resources Program with a cold store facility and staff who are well versed in collecting, administrating and maintaining seed collections. NCARTT has expanded its remit into conserving seed collections of wild species *per se* after being approached by the Millennium Seed Bank project. This resulted in the signing of a formal Agreement in February 2001 that has since led to a first joint collecting mission. Training opportunities and joint work on data management and GIS are also being developed, while seed collecting will be carried out mainly by the Jordanian counterparts, supported by the MSBp.

Top: collecting various species simultaneously.
Middle: collecting *Ephedra pachyclada*. (Boiss.)
Bottom: a southern Jordan dryland landscape.



Left: Elephants on the Etosha Pan, Namibia.

Namibia

Namibia's National Plant Genetic Resources Centre (NPGRC) in Windhoek has had a long association with RBG Kew's Seed Conservation Department, and became a partner of the Millennium Seed Bank project on 2 May 2001. The project manager, Herta Kolberg, has already developed a targeting protocol to ensure that the MSBp and NPGRC collect the most important of Namibia's more than 4000 higher plant species.

Namibia is a country of deserts, and includes the Namib, Kalahari, Kakaoveld and Skeleton Coast deserts within its boundaries. It is also home to the oldest plant in the world, *Welwitschia mirabilis* (Hook.f), and around 600 species which grow nowhere else.

Madagascar

A recent report on the Millennium Seed Bank project collaboration with Silo National des Graines Forésières (SNGF) in Madagascar showed that of the 140 species collected so far, 48% are recorded as being useful to man. Of the 96 collections identified to species, 74% are endemic to Madagascar. We would like to take this opportunity to welcome Mr Thierry Rakotomamonjy to the SNGF team, who will be working on the plant identification aspects of the collecting programme.

Millennium Seed Bank staff visit China

International Symposium on Ecological Construction and Biodiversity Conservation in West China
中国西部生态环境建设和生物多样性保护国际研讨会
October 3-7, 2001 • Urumqi • China



Collaboration with China took another step forward recently. Following the successful visit to the WTMB in July this year of Governor Liang, who led a delegation of Yunnan Science and Technology Commission and Chinese Academy of Sciences (CAS) personnel, Roger Smith (Head of the Seed Conservation Department) and Hugh Pritchard (Head of Research) paid a reciprocal visit to Kunming in October. China is developing plans for a wild species gene bank for west China, and Roger and

Hugh met with Li De-Zhu and colleagues of Kunming Institute of Botany and CAS to discuss how the MSBp could support the Yunnan project. As a measure of the growing relationship between the projects, there was a joint presentation on the prospects for seed conservation of west China plants at a conference in Urumqi, Xinjiang Province, northwest China, part of China's drylands. Key CAS personnel involved in biodiversity conservation were present. Discussions also took place with Prof. Liu Hong-Mao,

Delegates, including Hugh Pritchard and Roger Smith (front row, right), attending the International Symposium in Urumqi

Director of the Xishuangbanna Tropical Botanic Gardens (XTBG), over the extension of the existing research collaboration, and agreement was reached on receiving a researcher from XTBG throughout 2002. The successful visit ended with a dinner with Governor Liang, other Government officials and members of CAS.

Western Australian species under the microscope

Recently I was fortunate to be able to conduct research on seeds for 3 months at the Millennium Seed Bank under the guidance of Dr. Robin Probert, Head of Training and Technology. Funding for my travel and accommodation came from a June Craig Award for Women in CALM (the Western Australian Department of Conservation and Land Management) and the MSBp. The primary aim of my stay was to assess the germination requirements of seed of several poorly known Western Australian species. These seeds are being stored at the MSB and at our own Threatened Flora Seed Centre (TFSC) as part of the collaborative project, and had proven somewhat difficult to germinate under standard laboratory conditions. Using the MSB facilities, I was able to establish comprehensive trials, providing seed with additional treatments to ensure maximum germination. A pilot seed ageing experiment was also carried out on seeds of three species in the family Myrtaceae. These seeds maintained high viability despite my best efforts to provide them with conditions that should have caused their death!

Part way through my stay I was joined by my colleague Andrew Crawford. Andrew is employed as a seed collector and researcher under the MSB collaboration. His visit was funded under the MSBp. During the 6

weeks of Andrew's visit, he carried out germination trials on 8 commercially important *Acacia* species with the aim of increasing both rate and percent germination. He also took part in the seed-banking module of the *Plant Conservation Techniques* course at the end of August.

The highlight of our visit was the workshop *Seed Conservation: Turning Science into Practice*, well attended by a distinguished international field of seed practitioners and providing a magnificent forum for information exchange and networking.

The well-equipped and spacious laboratories of the MSB provided the means to conduct research that would have been difficult to conduct using our own facilities in Western Australia. Throughout our stay we were always made to feel "at home" and treated like staff members. Our visit enabled us to establish a working relationship with many of the MSBp staff as well as with other international partners in the project and we are very grateful to have had this opportunity to strengthen the collaborative ties.

Anne Cochran,
Western Australian Department of Conservation

Research on Kenyan Orchid Seeds



Chamaeangis sp.

Studies of orchid seed storage characteristics have indicated that orchid seeds broadly fall into the 'orthodox' storage category. Reducing both storage moisture content and temperature generally enhances their longevity. Therefore, banking of orchid seeds is a potentially viable *ex situ* conservation practice, conserving maximum genetic diversity for long periods at comparatively low costs. However, some aspects of seed banking need to be evaluated and improved before long-term seed storage of orchids can become optimised. The

Millennium Seed Bank project is

investigating methods for the preservation of orchid seeds (and their fungal symbionts), as well as developing rapid viability assessment protocols for such microscopic germplasm.

Kenya has about 280 species of orchids. However, the survival of many is threatened, due to the continued degradation of their natural habitat by human activities. Hence there is a need for their *ex situ* conservation, especially those in high-risk areas. The National Museums of Kenya have acknowledged this need with the "Seeds For Life" project and orchid conservation is a main target of the programme. The aim is to collect and conserve orchid seeds of vulnerable target species. It is on this basis that a collaborative research programme with the MSB was developed, with a view to capacity building and better understanding of the storage behaviour of tropical orchid species. Several aspects of Kenyan orchid seed storage have been examined at the MSB recently, including:

- Viability testing, using the Fluorescein Diacetate (FDA) test (previously tested on mainly European species).
- Seed anatomy studies (with the Jodrell Laboratory, Kew).
- Liquid nitrogen storage (-196 °C) and its effect on viability of the seeds. In the future, the applicability of the encapsulation-dehydration technique, which has been successfully used to cryopreserve UK orchids with their fungal symbionts, will be assessed on tropical Kenyan species.
- Germination requirements and optimum conditions, compared with those of temperate orchid species.
- Ageing experiments, which were carried out in order to predict their longevity in storage.

Material used for the study was collected from Kenya and constituted nine terrestrial or epiphytic species.

For more information contact:

George Mugambi,
National Museums of Kenya,
PO Box 40658, Nairobi, Kenya
mbegu@wananchi.com

or **Dr Chris Wood**
+44 1444 894157
c.wood@rbgkew.org.uk

Photographs © Board of Trustees, Royal Botanic Gardens, Kew.



Polystachya sp.



Habenaria sp.

Habenaria sp.

NEWS

New staff

Clare Tenner is the new International Programme Officer for the MSB project. She works with the International Co-ordinators on issues of relevance across the country projects such as international environmental policy initiatives, funding, communications and project tracking. Clare previously worked for a UK NGO on international climate change policy. She can be contacted on +44 1444 894121 / c.tenner@rbgkew.org.uk.

IUCN develops Ex Situ Policy

The World Conservation Union (IUCN) Species Survival Commission has developed a draft 'Policy on the Management of Ex Situ Populations for Conservation'. The Policy recognises that the survival of as many species as possible will require an increased role and use of *ex situ* conservation, and states that effective integration between *in situ* and *ex situ* approaches should be sought wherever possible. A stated goal of the draft policy is that 'ex situ agencies should work with range states (with the legal mandate for access and benefit sharing agreements) to collaborate in the precautionary propagation of threatened species (according to the 2000 IUCN Red List Categories)'. Furthermore that 'those responsible for ex situ wildlife populations will use all resources and means at their disposal to maximise the conservation values of these populations for the world's biodiversity'. The draft then goes on to give guidelines for *ex situ* conservation designed to maximise the effectiveness of *ex situ* collections.

Following a review period, the draft policy will be submitted to the IUCN Council in November and should be approved shortly thereafter.

The draft can be found at the IUCN webpage at www.iucn.org/themes/ssc/mononly/exsitu. Alternatively Clare Tenner, at the MSB, can provide copies. Contact Clare on +44 1444 894121, c.tenner@rbgkew.org.uk.

Several hundred years in the life of a seed: the work of the Curation Section of the Millennium Seed Bank project



It so happens that today starts with the arrival of a delivery van containing the latest batch of seed collections to be sent from our overseas partners. Curation staff take the unopened packages straight into the dry room for unpacking. This room runs at 15°C and 15% relative humidity. It is also a contained environment so any escaping insects can be captured and destroyed. Two Curation staff, James Wood and Stephanie Miles, begin to unpack the consignment which, this time, has arrived from Lebanon. The new packages contain a large number of cloth and paper packets, herbarium presses packed with dried specimens, field data sheets, and unused collecting equipment. The seed samples are opened, checked and logged, before being placed into open-sided crates to begin drying. The herbarium specimens are also checked and logged before being placed at -20°C to kill any stowaway insects. The data sheets are taken to Jill Bone, our data supervisor, to be entered into the Seed Bank Database. This information will be attached to the herbarium specimens. These are

sent to the Herbarium at Kew for identification and storage.

Over a period of several months, the eight Curation staff process the collections further. First they will be cleaned as far as possible without damaging the seed. A small sample is then x-rayed to assess seed quality. When this proves satisfactory, the collection is counted. Before being placed at -20°C, the seeds are dried for a further four weeks. They are then split into an Active sample, (a small amount, which will be used for testing and distribution), and the Base, which holds the bulk of the collection. This Base can be stored for hundreds of years and will not be opened in the short term. A sample of seed is now removed from the Active store and will be used in a series of germination tests. If the Access and Benefit Sharing Agreement permits, the seed may be used for distribution around the world in various research programmes. The work of the Curation Section is now over for the Lebanon collections but who knows what may be in the next parcel to arrive at the MSB.



International Undertaking on Plant Genetic Resources for Food and Agriculture

Since 1994, the member countries of the FAO Commission on Plant Genetic Resources have been negotiating the revision of the International Undertaking (IU) on Plant Genetic Resources for Food and Agriculture, to bring it into harmony with the Convention on Biological Diversity (CBD). Much of the text of the revised IU was adopted in Rome in June 2001. The revised text includes agreement on the establishment of a multilateral system for access to plant genetic resources, conditions for facilitated access, benefit-sharing (including a commercial benefit-sharing package), farmers' rights, financial resources, the involvement of the International Agricultural Research

Centres of the CGIAR, and many institutional and legal provisions. A list of some 35 food crops and 29 forage crops has, thus far, been agreed as the scope of the IU. Delegates met again in November 2001 to finalise the definition of 'plant genetic resources for food and agriculture' & 'genetic material', in addition to finalising the relationship of the IU with other international agreements, restrictions on the ability of recipients to take out intellectual property rights on materials from the system, and the legal basis for the IU. They also discussed a broader list of crops. There will be more in a future issue of Samara on the IU, when the next stage of negotiations has been concluded.

WE WANT TO HEAR FROM YOU!

Samara is your newsletter, so send us news and articles about yourself and your work.

Contact the editor **Fiona Ainsworth**,
Librarian & Information Officer
Royal Botanic Gardens, Kew
Wakehurst Place, Ardingly, West Sussex, RH17 6TN, UK.

tel: +44 1444 894178 fax: +44 1444 894110 email: f.ainsworth@rbgkew.org.uk



samara