The Millennium Seed Bank Partnership: enabling adaptation and innovation

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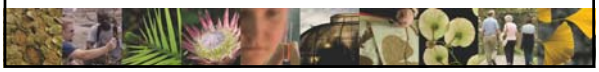
Head of Kew's Millennium Seed Bank Project



Outline of talk

- Why plant diversity is important
- The role of botanical research: the MSB Partnership
- The MSB Partnership building research capacity through training and technology transfer
- The MSB Partnership enabling use through research: case studies
- Impediments
- Recommendations
- Conclusions

Why plant diversity is important

All life depends on plants

Provisioning services

Food, medicine, fuel, construction, clothing, etc.

Regulating services

Climate moderation, disease regulation, flood regulation

Cultural services

Spiritual, recreational, aesthetic, inspirational, educational

Supporting services

Soil formation, nutrient cycling, primary production.

Economic value $30-40 trillion per annum.

Plant diversity for livelihoods: nutrition

Globally, 80% of our plant-based calorie intake comes from just 12 domesticated plant species, 8 cereals and 4 tubers.

An estimated 30,000 species of plant are regularly eaten by people.

Can we continue to rely on such a tiny fraction of edible plant diversity for all our future needs?

Plant diversity for livelihoods : health

Do we have all the medicines we need?

75% of the world's population relies on traditional medicines.

Traditional Chinese medicine uses >5000 plant species. 7000 species are used for medicine in India.

The role of botanical research: Kew's mission

Kew's mission is to inspire and deliver science-based plant conservation worldwide to enhance the quality of life

Kew's role, and that of other botanic gardens, is to develop relationships with society that enable human innovation, adaptation and development.

Our role is primarily in providing plant-based solutions to the environmental challenges that we all face.

The role of botanical research: the Millennium Seed Bank Partnership

MSBP Conceived, developed and managed by RBG Kew

Funded by U.K. Lottery, corporate and private sponsors (£75m)

Phase 1 (1997-2000): Collect U.K. native flora and build Millennium Seed Bank

Phase 2 (2001-2010): International Programme

wellcome trust | orange | The National Lottery

The role of botanical research: the Millennium Seed Bank Partnership

Target 1

Collect 10% of the world's seed-bearing flora, principally from the drylands, by 2010

Target 2

Develop bilateral research, training and capacity building relationships worldwide in order to support and advance the seed conservation effort

The role of botanical research: the Millennium Seed Bank Partnership

The concept of global seed banking has been proved by the Millennium Seed Bank Project, and it is based on:

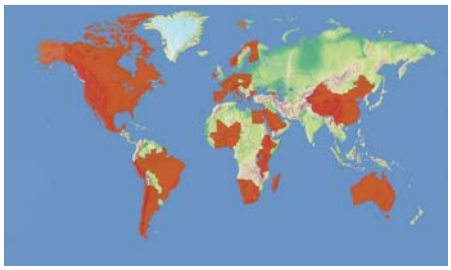
Partnerships

Collections

Training and technology transfer

Problem solving through research

The role of botanical research: the Millennium Seed Bank Partnership



MSBP: >120 partner institutions in >50 countries

The role of botanical research: the Millennium Seed Bank Partnership

18 countries
12 forestry institutes
9 agricultural institutes
9 universities/research centres
3 botanic gardens
2 NGOs

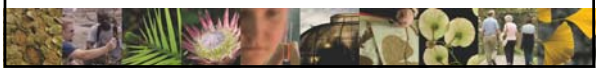
The role of botanical research: the Millennium Seed Bank Partnership

THE CONVENTION ON BIOLOGICAL DIVERSITY

Conservation

Fair and equitable sharing of benefits

Sustainable use



Prior informed consent. Access & Benefit Sharing Agreements

Ownership

Consent

Activities

Notification of transfer

Benefit sharing

Non-commercialisation

Transfer to third parties

Duration

The role of botanical research: the Millennium Seed Bank Partnership

The Millennium Seed Bank Partnership is the largest ex situ wild plant conservation programme in the world.

22,000 species secured in safe storage to date. 25,000 by 2010.

3 billion seeds collected so far.

Mean collection size = 32,000 seeds.

One third of collections are from plants used in subsistence livelihoods.

Building research capacity through training and technology transfer

Since 2001, Kew's Millennium Seed Bank Partnership has:

- Trained > 1300 agriculturalists, horticulturalists, foresters, botanists, ecologists etc. in seed conservation via in-country and UK-based training courses
- The Chinese team trained at the MSB have, in turn, trained 183 people who have subsequently made 11,290 seed collections

Building research capacity through training and technology transfer

Since 2001, the Millennium Seed Bank Partnership has:

- Provided >£14 million to partner organisations to support and advance the seed conservation effort
- Provided advice on the design of seed bank facilities to 22 institutes in 14 countries

Building research capacity through training and technology transfer

Rotronic hygrometers delivered to 15 MSB partner countries

The MSBP: enabling use through research

Development of germination protocols are a vital and novel output of the Millennium Seed Bank

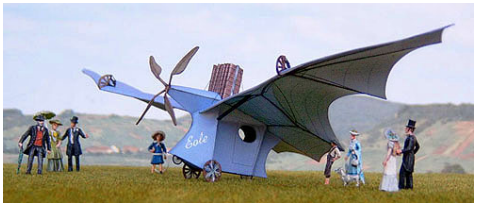
Currently >10,000 germination tests carried out each year. For most species the methods are new.

All germination protocols are available on Kew's website at http://www.kew.org./data/sid

The MSBP: enabling use through research

Supporting innovation

>4000 collections sent out for research into water, environment, health, agriculture and biodiversity since 2001



The MSBP: enabling use through research

Case study 1: Combating dryland salination in Australia

5.7 million ha of agricultural land currently affected

Department of Agriculture, Western Australia

MSB supplied 43 collections of perennial legumes for rainwater interception

South Australia Research and Development Institute

MSB supplied 154 collections of salt tolerant pasture plants

www.nicholsoncartoons.com.au

The MSBP: enabling use through research

Case study 2: Culturing threatened medicinal plants in Pakistan

Pakistan obtains >80% of its medicines from higher plants

Dept of Biology, Quaid-i-Azam University

MSB supplied 7 *Artemisia*, 5 *Digitalis*, 2 *Ammi* and 1 *Arnica* species for research into enhancing production of secondary metabolites through tissue culture.

The MSBP: enabling use through research

Case study 3: Developing C4 photosynthesis in crop species

C4 plants account for 20-30% global terrestrial productivity but are only 3% of angiosperms

Washington State University, Pullman

MSB supplied 32 seed collections of 13 genera of C4 families for screening for C4 photosynthesis without Kranz anatomy.

The MSBP: enabling use through research

Case study 4: improving the identification, handling and storage of 'difficult' Seeds

•38 participant countries from sub-Saharan Africa:

•Access to protocols and information in scientific literature

•Dissemination of methodologies and information on difficult species

•Training in seed handling and conservation

•Acquisition of basic equipment

The MSBP: enabling use through research

217 'difficult' species

51 crop species (maize, millet, rice etc.)

40 fruit trees (33 native)

151 native species (vegetables, medicinal, ornamental etc.)

38% (82) of the species had handling/storage problems

52% (112) had germination problems

For 46 of the 112 species with germination problems we already have protocols that deliver >75% germinability

The MSBP: enabling use through research

Seed and expertise from the MSBP is currently being employed in restoration and reintroduction programmes in the U.K., USA, Australia, Madagascar and South Africa.

Restoration of natural capital will become an increasingly important technology as the effects of climate change become more marked. Botanic gardens are uniquely placed to enable these efforts.

Impediments to progress

- Insufficient high quality seed material available for research
- Insufficient range of plant diversity available
- Access to material restricted
- Lack of engagement from industry
- Convention on Biological Diversity?
- Commercialisation and access versus benefit sharing

Recommendations

Influencing policy

- EPSO to support biodiversity component of climate change and environment theme under FP7
- EPSO to support wild species seed banks and similar biodiversity repositories under FP7 infrastructures

Recommendations

Influencing best practice

- EPSO to encourage dialogue between industry and biological repositories to facilitate access to material, and development of new products.
- Case studies to be developed showing best practice access and benefit sharing under the CBD.
- EPSO to be proactive in identifying problems under the CBD that stifle innovation.

Conclusions

Our current and future role is to develop relationships with society that enable human resilience, adaptation and innovation. Our role is primarily in providing plant-based solutions to the environmental challenges that we face.

We invariably work in partnership, employing a complementary approach of technology transfer and exchange of skills.

Significant impediments remain that stifle innovation and plant product research.