

## Breakout group brainstorming sessions

### Q1. – What do you expect from barcoding?

- A simple, efficient scientific tool for distinguishing between species
- Forensic applications – current examples given included fragments of plant material on explosives identifying country of origin and lodged in car tyre treads revealing habitat information. The question of ‘barcoding’ furthering this kind of investigative process was raised, ie allowing accurate identification from smaller, unrecognisable fragments or components.
- A concern regarding a deskilling of taxonomy and taxonomists as a result of barcoding automation.
- Conversely barcoding techniques could create a demand for taxonomists to verify accuracy of data.
- Potential to contribute to the CBD target of conserving genetic diversity.
- Useful additional tool for biological monitoring / amateur naturalists.
- Controversy / suspicion / misinterpretation of the term ‘barcoding’. It is not helpful in communicating what the tool really is. Perhaps the term ‘diagnostic’ could be substituted?
- Reduction in unnecessary sampling/disruption in the field (much less material needed for DNA identification than may be needed for traditional identification)
- Providing new insights and possibilities for studying the natural world, in particular less well-known groups e.g. bryophytes
- Increased clarity in taxonomy.
- Could offer a gateway to a wide range of information about organisms rather than just an identification. This could promote a greater appreciation and interest in the natural world.
- Some concerns that it may have a negative impact by demotivating enthusiasts who take the time and effort to develop skills and expertise in the identification of organisms in the field using morphological characters.
- Different stakeholders expect different things, thus important to sector the audience and tailor communications appropriately
- Detection of cryptic, or hidden, species
- First, a universal tool (with universality prioritised over power), then secondly work on increasing resolution with more work (not trivial)
- The present project should deliver an archive of new specimens (herbarium specimens and frozen tissue samples), a positive byproduct
- molecular type specimens?
- Management of expectation is important - will end users and public begin to expect more than can be delivered? (for example public will expect ability to identify garden plants but these are mostly alien)
- Public enthusiasm to be generated in underappreciated groups e.g. fungi, diatoms

### Q2. What type of information do you want?

- In terms of biological recording – an accurate name.
- Quality assurance! ...in all areas, molecular, taxonomic, database, security, etc.
- When considering a wider habitat, the information should relate to the needs of the habitat and the relationships between components.
- The history, local, regional and national relevance (e.g. distribution information).
- There was a feeling that there could be a potential role to play by the recorder in validating the record(s)
- Should enable identification of species at all stages of development / lifecycle, therefore allowing use over a wider time period. Particularly relevant in terms of enabling single broad habitat surveys.
- Will allow efficiency in terms of survey effort. Rather than a large number of specialists visiting an, an assessment could be done by fewer people, suitably equipped with the technology.
- Easily accessible data (facts and figures) to engage lay people / non experts in conservation action.

- Some idea of the confidence in an identification is necessary – particularly in groups with hybrids, polyploids etc.
- Want DNA extraction methods for herbarium material
- Positive feedback between molecular data and morphological taxonomy leading to new recognition of previously unnoticed morphological differences
- Ability to detect alien species

Q3. How will this technique complement your own work?

- Will potentially enable everyone with a hand held device to become a biological recorder and broaden the audience able to contribute to conservation action / knowledge.
- Help enforce restrictions of transport / trade of plant species.
- Enable non-experts in particular groups in remote places to identify species.
- Will allow confirmation of stated identities, such as horticultural stock (often mis-labelled).
- Will identify possible cryptic or hidden species for follow-up.
- Will create new source of data with which to test biological hypotheses
- Analysis of large data sets will enable the testing of larger-scale hypotheses and generation of new types of insights

Q4. Would it change your working practices?

- Yes – in the area of forensic science.
- Would possibly lead to a need for re-skilling / acquiring new skills.
- Provide different avenues of scientific enquiry.
- No agreement on whether or not barcoding would free up time for experts to focus on tasks other than routine identification.
- Little direct impact for people working on cultivar identification but important to make sure that DNA barcoding and parallel systems developed for cultivated plants are compatible.
- A shift in focus from type specimens to species barcodes as standards?

Q5. What difficulties or problems might barcoding create?

- The need to trust the data with the question of human error in all aspects of the process, both molecular and the identification of the voucher specimen by a taxonomist
- Lack of confidence (or, conversely, overconfidence) in results.
- The technique could potentially generate huge quantities of information. We have to question if we are ready or able to adequately cope with this.
- Similarly, the process of gathering the data will create the need for more space for voucher specimens and tissue banks; will we be able to provide the physical space for these materials, on a global scale?
- Is this project globally viable? Will it help/hurt efforts to document/protect taxa in the developing world?
- Will yet another drive for information (often said to be a prerequisite for conservation) actually provide an excuse for continued inaction in conservation?
- It could alter the perception of species limits and require much redefinition / taxonomy and systematics.
- Easy identification could encourage wilful damage of species in situ.
- There is a danger of cross contamination in the field (e.g. pollen / microbes) if adequate training or understanding of the technique is not given.
- There could be confusion regarding the issue of contamination if there is not full understanding of the technology. (e.g. human / insect contamination and the issue of different regions and markers).
- Single gene was proposed for all life to ensure uniformity of application, but as co1 will not work for plants, there will be multiple markers for different kingdoms. Will this cause problems for identifying both plant and animal fragments and/or microorganisms in environmental samples? (simultaneous plant- and animal-specific PCR might solve this)
- Over-use of the technique / inappropriate use (where an alternative would be more effective) as a result of the appeal of new technology.
- The technique needs to be developed with sensitivity to address the potential interpretation of leading to a 'de-skilling', particularly in a climate of a decline in taxonomic skills. An emphasis on the technology as an additional 'diagnostic tool' may be the answer.

- Does increased accessibility of what was once a rare skill to the larger public represent a devaluation of those who were previously the “keepers” of that knowledge?
- Chloroplast marker will not detect hybrids; similarly, a question: can chloroplast markers be amplified from root material, etc which lack chlorophyll?
- Limitations of the resolution of the technique might need to be paired with other techniques
- Might misidentification of organisms introduce legal implications (especially with regard to criminal forensics); noted, however that this problem exists with any identification method
- Global differences in nomenclature and species concepts might make cross-applicability difficult

Q 6. What opportunities will it present for your work?

- Extensive reanalysis of species definitions
- Could result in a simplification via a reduction of ‘duplicate’ species internationally when detailed comparisons haven’t been easy to make previously.
- We can learn many useful lessons from the experiences of other disciplines, such as the police DNA database work, the human genome project and forensic science.
- We must appoint a limited number of authoritative organisations responsible for inputting and maintaining the databank, ensuring the highest standards and reliability.
- Could enable a faster decision making in conservation if species identification is faster and more reliable.
- Site assessments would be more accurate and include rare / niche / difficult to identify species that can otherwise be over-looked by ‘generalists’. This could be particularly important in EIAs and development planning.
- Will anchor finer scale investigations, e.g. “population barcoding” and introduce the need for more investigation in this area
- Power will increase when other floras are barcoded and thus aliens can be positively identified