discovery and understanding. DNA barcodes provide one such tool. Based on short stretches of DNA that are easily sequenced and variable enough to distinguish among species, barcodes provide a rapid assessment of taxonomic similarity and genetic distinctness. As a first pass in identifying new taxa, DNA barcodes alert us to the existence of unknown species and may lead us to test the validity of previously described taxa. In addition the assembly of DNA barcode libraries for species-rich natural communities greatly enables ecological studies where accurate species identifications are required. Finally, well-resolved molecular phylogenies of naturally co-occurring species derived from DNA barcode sequences have the potential to improve investigations of the mechanisms that underlie the assembly of plant communities and the evolution of plant functional traits. DNA barcodes, if applied appropriately, will enhance future research focused on the interface between species discovery, taxonomy, ecology, and evolution.

KNS10: The past, present and future of plant diversity

Patterns in the history of plant diversity: testing, reconciliation and accounting for missing data

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Evidence of the structure, biology and diversity of extinct plants derived from paleobotanical research over the past 200 years has greatly expanded our view of the history of plant life and provided insights into key events in plant evolution that would have been inaccessible from studies of living plants alone. In general, there is remarkable consistency between the large-scale patterns of plant evolution inferred from studies of living plants and those obtained from studies of fossils. However, two areas have emerged since the last botanical congress where this reassuring consistency seems to have broken down, and where paleobotanical and neobotanical evidence appear to conflict significantly: the pattern of phylogenetic relationships among seed plants, and the antiquity of certain lineages of angiosperms (with the associated implications for the antiquity of certain kinds of biomes). In both instances questions of missing data seem to be at the heart of the problem. As a paleobotanist I worry about the impact of extinct taxa on inferences of seed plant relationships based on living plants alone. While acknowledging the inadequacies of current phylogenetic analyses based on structural data I am unwilling to abandon those results entirely in favor of other patterns of relationship that while based on vast amount of molecular data are likely to be from an inadequate sample of taxa. At the same time, those who use molecular dating techniques to determine the age of clades acknowledge the limitations of current models of molecular evolution from which such ages are derived. Nevertheless, they seem more comfortable with their own results than trusting to the completeness of the fossil record. In this talk I will argue that neither neobotanists nor paleobotanists will ever have the data that they would ideally want to address these questions, but combined efforts and opportunities for partial reconciliation offer the promise of more robust hypotheses. Fresh perspectives on key questions of plant evolution are possible, but are less likely to come from approaches that fail to account for all of the available data.

The future of plant diversity

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A recent assessment by the Sampled Red List Index indicates that as many as one fifth of the world's estimated 380,000 plant species are under threat. This suggests that some 76,000 plant species are in danger of extinction from a broad range of threats including habitat loss, habitat transformation, over-exploitation, alien invasive species, pollution and rapid environmental change. Although the disappearance of such a critical component of biodiversity poses one of the greatest challenges for the future it is encouraging that there are now key strategies being developed and implemented which are directed towards addressing and recovering this potential loss. For example, the Global Strategy for Plant Conservation set 16 outcome-oriented global targets for 2010 that provided an important starting point for improving world plant diversity conservation. One such target Target Eight of The Global Strategy for Plant Conservation recommends that '60% of threatened plant species' should be 'in accessible ex situ collections, preferably in the country of origin and 10% of them' should be 'included in recovery and restoration programs' by 2010. Based on current estimates by the end of 2010 some 4,560 plant species worldwide should be in reintroduction programs. Such goals may be ambitious and considered unrealistic by some. However, as shown in Western Australia, with a flora of 12,200 species, they can be achieved and even exceeded with 70% of the threatened flora in ex situ conservation and 13% used in reintroductions. Equally the goals for ecological restoration can set very high benchmarks but a bold and proactive approach where actions are implemented now, perhaps without full knowledge, but in an adaptive management framework will need to considered if successful plant diversity conservation is to be achieved. Loss of some plant diversity is inevitable but the magnitude of that loss will depend on our ability to implement strategies already in place, develop new strategies and integrate current knowledge in plant conservation science with on ground actions. For example, the introduction of plant species outside their natural range in response to the threat of climate change has been raised recently as a key tool in plant translocations. While achieving long term persistence particularly in the face of rapid environmental change may require a reassessment of how we manage genetic diversity, maximise evolutionary potential and deal with local adaptation. Also recent strategic approaches to combining ex situ and in situ conservation that involve the creation of artificial populations of plants that can be subsequently used for reintroductions and restoration have considerable potential for enhancing plant diversity conservation. These approaches will be discussed in the context of future goals and actions that will be needed to halt and even reverse the global loss of plant diversity.

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