DIVERSITY AND ADAPTATION IN FOREST ECOSYSTEMS IN A CHANGING WORLD

A IUFRO symposium with the above title was organized by Francis Yeh (University of Alberta) in Vancouver, Canada, on the campus of the University of British Columbia between August 5 and 9, 1996. A joint initiative of two research groups (IUFRO S2.04.01 Population, ecological and conservation genetics; P2.05.05 Genetic aspects of air pollution and climate change), the meeting focused on the genetic aspects of conservation strategies of temperate and tropical forest trees.

The selected topic was covered by 12 invited speakers (G. Namkoong, O. Savolainen, Cs. Mátyás, A. Kremer, K. Ritland, R. Petit, D. Neale, F. Scholz, T. Boyle, G. Müller-Starck, J. Kleinschmit and O. Rajora) and by 17 voluntary papers and 37 posters. During lively discussions a fair amount of consensus was reached on the main issues, although formal conclusions have not been formulated. In the followings a brief account is given on discussed topics pertinent to genetic conservation strategies.

The main questions addressed concentrated around the issues

- how genetic markers may help to understand genetic processes in forest tree populations;
- what are the options to conserve forest genetic resources; and
- how to integrate genetic information in forest policy and management decisions.

Studies in adaptation and genetic processes in forest tree populations reveal that selection processes both in unaffected and changing environments (as a result of logging, climatic effects, industrial pollution) are rather complex and species-specific. Resulting genetic patterns depend on the evolutionary past, mating conditions, the genetic system of the species etc.; integrating directional and random processes which lends a certain robustness in response on the population level. Genetic variation has to be considered as a compromise of evolution and environment with no "perfect" adaptations. Under these conditions the main concern of conservation should be instead of conserving a certain genetic structure or certain (rare) alleles, rather the safe maintenance of genetic processes in order to secure the adaptational potential of the species.

In the recent years the overwhelming development in molecular biology provided an ever-increasing array of tools to study genetic variation and genetic processes. The different types of genetic markers should be carefully selected and interpreted according to the question to be answered. Genetic parameters on variation and processes (mating, migration, directional changes) can be utilized as indicators of sustainability (verifiers) which may assist in management decisions. The main focus should be on understanding the functioning of the genetic system; genetic markers can provide valuable assistance in this respect but cannot be regarded as unique means of analysis. With respect to adaptive, quantitative traits which are of primary importance, the contribution from molecular studies is not satisfactory yet. A drawback in adaptational interpretation is the lack of sufficient ecological information. On the other hand it has to be stated that in general little of the available genetic information has reached ecological thinking. In the future genetics should be included in ecological models and analysis.

It was felt that the problem of conserving forest genetic resources cannot be focused on the relatively few intensively studied, commercially important species alone. It has to be born in mind that globally there exist more than 50 thousand tree species, out of which at least thousand have to be regarded as potentially important. Compared to these numbers, the volume of intensively analyzed taxa represents with approximately 50 to 60 species barely 0.1 % of the total. In view of these relations the only prudent solution to conservation will be if issues of diversity conservation can be adopted in forest management, in silvicultural practices. While the establishment of ex situ conservation plantations and in situ gene reserves may play regionally an important role, the adoption of genetic principles in forest policy has to be emphasized, as being the only effective means to achieve progress on a global scale. A high priority was assigned to provide sufficient information in order to promote the formulation of guidelines, priority lists and to contribute to decision supporting systems facilitating the implementation of genetic principles in management.

Comparing temperate and tropical ecosystems, conditions for genetic conservation are rather differing. While genetic information on tree species of commercial value are becoming relatively abundant in the temperate zone, the complex nature of tropical ecosystems have been scantily surveyed in this respect, although the need to implement genetic knowledge to sustainable maintain biodiversity is much more urgent. Potential threats to temperate forest genetic resources also substantially differ from those in the tropics: climatic instability and industrial pollution are the main threats in the northern hemisphere, while forest exploitation and especially land use changes are the most serious sources for genetic (biodiversity) losses in the tropics. While the global situation of forest genetic resources should be the starting point of all thinking, a differentiated approach is therefore needed when deciding on regional implementation of genetic conservation strategies.

The invited papers of the meeting will be printed in a proceedings volume edited by Francis Yeh. The publication is expected mid next year at Kluver Publishers, the Netherlands.

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