

# What you should know about the module

When planning research, it is crucial that the questions you address are well defined, even if other questions come along and you want to accommodate changes into the original plan as you progress. You must also know some of the principles of setting up experiments to ensure convincing results. In the context of your work with genetic resources, you need to be familiar with the foundations of genetic diversity and the available tools for examining your data so you can correctly interpret it.

Some of the concepts and tools we discuss include:

- Sampling strategies
- Basics of population genetics
- The mathematical measures used to describe genetic diversity, genetic distance indices and the methods used to express relatedness among samples
- Software and available Internet resources

The calculations involved in the key concepts of population genetics, measures of genetic diversity, indices and clustering methods are illustrated with examples that were prepared precisely for this publication. The user can then immediately see how mathematical expressions are applied. In addition, we want to show that, even though these calculations are often performed with the help of a computer program, most can be done manually. Even if a computer program is used, we believe the scientist should understand what the computer does and be able to develop his/her own criteria for deciding what method to use.

This learning module is intended to help those who want to analyse genetic diversity with the aid of molecular data. As such, it is not a comprehensive tool for learning about or teaching population genetics. However, we have listed bibliographic references to support significant notions of population genetics, to back up the mathematical expressions and provide for better comprehension of how the methods are applied in real-life research situations. The idea is that the learning module can be followed as a stand-alone tool to facilitate the learning process, in particular to help students, especially undergraduate students, understand how to choose amongst the applied molecular techniques in genetic diversity studies and to be able to apply them in their research projects. It can also be used for teaching and preparation of classroom lectures or as a reference guide by working professionals who need to apply molecular techniques, statistical methods and data analysis necessary to carry out research.

Users of this module must have basic knowledge of genetics. In addition, if they are not familiar with molecular marker technologies, we strongly recommend beginning the training by undertaking the first module *Using Molecular Marker Technology Effectively in Plant Genetic Resources: Learning Module*. Once the basic principles of these techniques are understood, the second module can be followed with a better basis to understand mathematical algorithms.

We have organized the learning module into complementary and independent submodules, so that the user may select at any point the section of interest. In some cases, we have given extra information, added as appendixes so not to

complicate the essential, yet providing further mathematical expressions or examples for those who would find them beneficial for a thorough understanding. This learning module is presented in such a way that either only slides may be used in a presentation format or both slides and accompanying notes.

Feedback on this publication is extremely important for us because we are convinced that it can always be enhanced. To respond effectively to our partners and other users' needs, we would greatly appreciate your giving us feedback on the organization, content and usefulness of this tool at the following addresses:

**M. Carmen de Vicente**

International Plant Genetic  
Resources Institute (IPGRI)  
Via dei Tre Denari 472/a  
00057 Maccarese  
Rome, Italy  
E-mail: [cdevicente@cgiar.org](mailto:cdevicente@cgiar.org)

**César López**

Universidad Nacional Agraria 'La Molina'  
Av. La Universidad s/n. Apdo. 456 Lima 12  
Lima, Peru  
E-mail: [cflb@lamolina.edu.pe](mailto:cflb@lamolina.edu.pe)

**Theresa Fulton**

Institute for Genomic Diversity  
130 Biotechnology Building  
Cornell University  
Ithaca, New York 14853  
E-mail: [tf12@cornell.edu](mailto:tf12@cornell.edu)

We sincerely hope that this module complements the previous module, *Using Molecular Marker Technology in Studies on Plant Genetic Diversity: Learning Module*, and that the two learning modules together offer our partners, especially those in developing countries with limited access to state-of-the-art technologies and comprehensive scientific literature or instruction, a chance to conduct advanced research in plant genetic diversity, thereby contributing to the world's knowledge of these valuable resources.

M. Carmen de Vicente  
IPGRI

César López  
Univ. 'La Molina'

Theresa Fulton  
IGD, Cornell University