

APPENDIX 2. Research approach of the ReForLan project.

The ReForLan project was a collaborative research initiative involving ten partner institutions, undertaken during the years 2007-9 (Newton 2008). The overall objective of the project was to identify and promote approaches for the sustainable management of dryland forest ecosystems, by researching ecosystem restoration techniques using native species of economic value. This was achieved by undertaking a programme of multi-disciplinary research that analysed how restoration of degraded dryland landscapes can be achieved in a way that mitigates the effects of unsustainable land use practices, contributes to conservation of biodiversity and supports the development of rural livelihoods, according to the FLR approach. Further details are given in Newton and Tejedor (2011).

The research focused on six dryland study areas in Latin America, including landscapes in Oaxaca, Veracruz and Chiapas, Mexico; northern and southern Argentina; and the Mediterranean region of central Chile (Figure A2.1, Appendix 3). In these areas, native forests have been subjected to intense human pressure in previous decades, resulting in severe deforestation and degradation. Each of these areas is characterized by biodiversity of international conservation importance, with many endemic and threatened species. These areas are also characterised by the presence of substantial and increasing rural populations, often including indigenous communities, who rely on native forest resources for provision of a number of forest products and services (Appendix 4). The restoration of forest resources in these areas is therefore of key importance to the livelihood of local communities.

Overall, the research undertaken during the ReForLan project aimed to identify how dryland forest ecosystems could be restored in ways that both benefit biodiversity and support the livelihood of local communities, and thereby contribute to sustainable development objectives. A conceptual framework was developed at the outset of the project to provide a basis for organising and integrating research activities (Newton 2008). This was based on the consideration of forest restoration as a potential response to environmental degradation caused by unsustainable land use practices. Such response options can usefully be viewed according to the DPSIR framework, which was developed by the European Environment Agency to help analyse the process of sustainable development (EEA 1998). The DPSIR framework is based on the fact that different societal activities (drivers) cause a pressure on the environment, which can cause quantitative and qualitative changes in the state of environmental variables. Such changes can produce a variety of different impacts on natural resources and the services that they provide to human communities. Society has to respond to these changes in appropriate ways in order to achieve sustainable development. According to the DPSIR framework, different indicators of sustainability can be developed relating to driver, pressure, state, impact and response variables; the development of such indicators was one of the outputs of the project (Newton 2011).

The research approach was based on the application of the DPSIR framework to restoration of dryland forest resources (Figure A2.2). The underlying drivers responsible for unsustainable land use patterns can be grouped into demographic, economic, socio-political, technological and cultural factors. For example, key factors underpinning current patterns of land use and land cover change in dryland regions of Latin America include the current policy context, the structure and function of national and international market chains for agricultural and forest products, and the process of globalization. Such factors influence patterns of land use, such as cultivation of crops and animal husbandry, which can have a major effect on the extent and condition of forest resources. Key variables describing the state of forest resources include forest area, the size distribution and connectivity among forest patches, and the composition and structure of forest stands (Figure A2.2). The way that human activities influence these

patterns will determine their impact on key ecological processes, such as dispersal, growth, survival, competition, succession and gene flow, which affect biodiversity and the provision of the environmental services on which human communities depend (Figure A2.2). The severity and extent of environmental degradation, and its impact on biodiversity and the provision of environmental services, will determine both the need and scope for forest restoration as a response option.

The ReForLan project was implemented as nine discrete, but interconnected elements (Figure A2.3), namely:

- (i) assessment of the deforestation of dryland forest ecosystems over the past three decades, using analysis of satellite remote sensing imagery supported by statistical modelling approaches and GIS;
- (ii) assessment of the fragmentation and degradation of dryland forest ecosystems, using analysis of satellite remote sensing imagery supported by statistical modelling approaches and GIS;
- (iii) analysis of the patterns of tree species richness in remnant fragments of dry forest, assessed through field survey in each of the study areas;
- (iv) experimental analysis of dryland forest restoration techniques, achieved by conducting a series of field experiments and restoration trials in each of the study areas, examining a range of different species and establishment techniques;
- (v) socio-economic valuation of dryland forest resources in each of the study areas, achieved using a variety of social survey techniques, including questionnaire surveys, interviews and participatory rural appraisal methods;
- (vi) analysis of the impact of forest fragmentation and degradation on patterns of genetic variation and its implication for forest restoration, using a range of molecular markers and quantitative genetic techniques to examine patterns of variation in selected tree species of high socio-economic value;
- (vii) exploration of the landscape-scale dynamics and potential for passive restoration of dryland forest ecosystems, using a spatially explicit model of forest dynamics (LANDIS-II);
- (viii) identification of priority areas for dryland forest restoration, using spatial Multi-Criteria Evaluation (MCE) approaches;
- (ix) development of policy recommendations and management strategies for restoration of dryland forest landscapes, through consultation with a range of stakeholders in each of the study areas.

LITERATURE CITED

- EEA. 1998. *Europe's Environment - The 2nd Assessment*. European Environment Agency, Office for Publications of the European Communities.
- Newton, A. C. 2008. Restoration of dryland forests in Latin America: the ReForLan project. *Ecological Restoration* 26 (1): 10-13.
- Newton, A.C., and N. Tejedor (Eds.). 2011. *Principles and practice of forest landscape restoration: case studies from the drylands of Latin America*. IUCN, Gland, Switzerland.



Figure 2.1 Location of the study areas included in the ReForLan project.

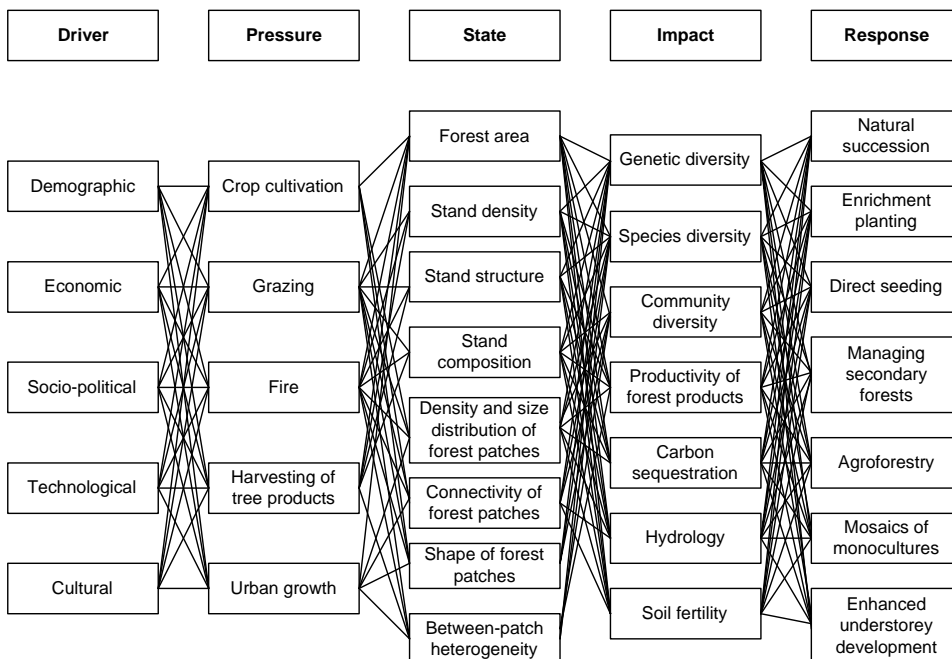


Figure A2.2 Schematic diagram illustrating the context of forest restoration as a response to unsustainable land use practices, according to a DPSIR framework (see text).

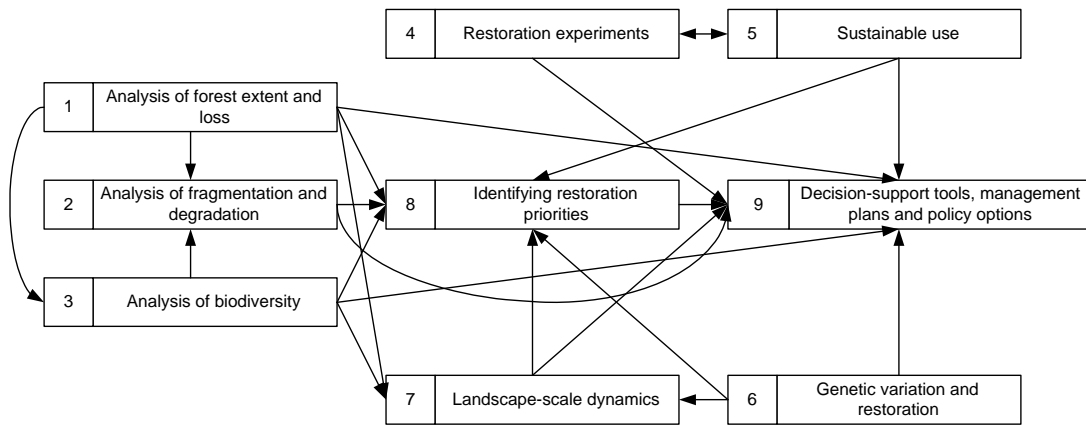


Figure A2.3. Inter-relationships of different elements (Work Packages, numbered 1-9) of the ReForLan project.