# Evaluation of remediation recommendations: Stakeholder Workshop 3 Secano Interior, Chile

## 1. Introduction

Mediterranean dryland areas of central Chile have been subjected for more than four centuries to significant degradation of their natural resources. Most of this two million hectare area is occupied by a traditional agricultural system that combines livestock activities with the production of cereals, in soils with high slope. As a result of the prevailing land use systems, about two thirds of "secano interior" soils are badly eroded (IREN, 2010), and soil organic matter and fertility are very low in many places. At the macro regional level, erosion has created a range of environmental problems, such as siltation of rivers and ports, and serious problems with flooding in both rural and urban areas. The parts of the country that face these environmental challenges are often the areas of the country with the greatest concentration of rural poverty and social inequity.

**Figure 1:** Land degradation problems in the Chilean study site

Description of the remediation strategies that were tested in WB4:

- Technology 1: no-tillage with subsoiling. No tillage preceded by subsoiling consists of the use of a subsoiler at a 50 cm depth every 5 years before performing no tillage agriculture. This technology permitted to mitigate water erosion compared to the traditional tillage.

**Figure 2:** Zero tillage machine tractioned by oxen. Seeding of lentils in the rainfed area of Ninhue County (Photo by Carlos Ruiz)

- Technology 2: crop rotation with legumes. These systems combine phases of legumes of different lengths, in which N is fixed and accumulated in the soil, followed by phases of

cereals where accumulated N is extracted. In this new rotation four legume-wheat rotations were compared to a monoculture crop rotation (wheat followed by oat). The legume species are: narrow-leaf lupin (*Lupinus angustifolium*); yellow lupin (*Lupinus luteus*); Peas (*Pisum sativum*); and a fodder mixture of vetch (*Vicia atropurpurea*) + oat.

**Figure 3:** Crop rotations experiments in the "secano interior" of Cauquenes (Photo: Soledad Espinoza)

- Technology 3: agroforestry systems. Under Mediterranean climate, water availability for woody species, especially in the first summer, is a key factor in the survival, growth and successful establishment of tree species. The use of conservationist systems of soil and water management allows a more favorable water balance, increasing water infiltration into the soil and their availability for the development of agroforestry species. Agroforestry species used were cork oak (*Quercus suber*), Quillaja (*Quillaja saponaria*) and a fodder tree call tagasaste (*Chamaecytisys proliferus*). This species showed the highest growth in height, crown diameter and trunk diameter. Among conservation structures, infiltration trenches favor the development of species, but are expensive and less efficient in retaining water in the profile, compared to subsoiling with ridge. This structure has shown an increase in moisture content over the infiltration trench between 0-70 cm deep.

**Figure 4:** System of multipurpose planting trees planting on infiltration trenches (left); and a system of multipurpose tree planting on a subsoil tillage ridge (right)

**2. Priority Remediation Strategies**

Priority remediation technologies selected in the final workshop are shown in Table 1. Table 2 indicates the scale at which each criterion was evaluated and Table 3 shows the grades given to each criterion for each technology. The strategies were chosen based on the economic, environmental

and social benefits that different technologies could offer. A very important set of criteria was all about economics, productivity, profitability and market access. Also, farmers and technicians who participated in the workshop have very well evaluated the subgroup of environmental criteria. So they chose primarily those technologies more profitable and more efficient in terms of control of erosion and mitigate land degradation.

**Table 1**: Ranking of remediation options before and after field trials and modelling in Chile

| Rank | Technologies ranked in WB3 workshop | Technologies ranked in WB4-5 workshop |
|---|---|---|
| **1** | No tillage with subsoiling | No tillage with subsoiling |
| **2** | Agroforestry systems | Crop rotation with legumes |
| **3** | Crop rotation with legumes | Agroforestry systems |

**Table 2:** Rating scale technologies

| High negative impact | Slight negative impact | Neutral | Slight positive impact | High negative impact |
|---|---|---|---|---|
| -2 | -1 | 0 | +1 | +2 |

**Table 3:** Grades allocated to every technology according to the assessment criterion

| Relevance Criterion | 0 lab + subsolado | Agroforestal | Rot. Cultivo - leguminosa |
|---|---|---|---|
| Yield / Productivity | 2 | 1 | 2 |
| Product market access | 1 | 1 | 2 |
| Profit margin | 2 | 2 | 2 |
| Access to financing | 2 | 2 | 2 |
| Access to machinery | -1 | 0 | 1 |
| Economic risks | 0 | -1 | -2 |
| Using local labor | -1 | -1 | 2 |
| Associativity development | 2 | 0 | 1 |
| Erosion | 2 | 2 | 1 |
| NR recovery time | 1 | 1 | 2 |
| Soil Organic mater | 2 | 2 | 1 |
| Protection RRHH | 0 | 0 | 0 |
| Environmental risk | 2 | 2 | 1 |
| Emissions reduction | 2 | 2 | 1 |
| Total | 16 | 13 | 16 |

**Figure 5:** Workshop participants

### 3. How can we enable priority remediation options to be adopted?

With regard to the potential for adoption of the technologies, the main issues that were highlighted by the farmers and technicians are related to:

1. Accessing economic incentives for the adoption of conservation practices. To include the technologies developed in DESIRE as part of the incentive program for the “Recovery of Degraded Soils” managed by the Agriculture and Livestock Service (SAG) which implies:

- Adjusting incentives according to timing of the expenses and investments; and
- Conditioning incentives to the adoption of the technologies

2. Generating a participatory approach for further transfer and dissemination of the results, which implies considering the production systems and the goals of the farmers
3. Developing an adoption model with local leadership - coordination between institutions - long-term institutional commitments
4. Training for technicians to support the adoption of the technologies
5. Evaluating the economic and social impact of the soil conservation practices

The main challenges to improving adoption rates was the need for mechanization for adopting zero-tillage and sub-soiling. The solution the participants proposed was to create and promote small companies of agricultural machinery, managed by farmers themselves. Two examples already exist in the counties of San Carlos and Ninhue.

**4. Feedback from participants**

Feedback about the workshop

The comments received from participants about the workshop were generally very positive. Farmers and technicians highlighted the importance of these types of workshops in which they can give their opinions regarding to the policies and tools of soil conservation, which are promotes by the Ministry of Agriculture in the region and in the country. They expressed the lack of discussion forums on the topic and the necessity to participate in the decisions that involve them directly. In this respect the DESIRE project was an excellent opportunity to make their views known regarding the national program of soil conservation and the way they think, that such might be more effective.

Feedback about the project

Regarding the project itself, participants highly valued the fact of having participated in the project from the beginning. This greatly facilitated the discussion of the results. They assessed the quantity and quality of the results, especially concerning the technologies on non tillage, sub-soiling and the new crop rotations. This aspect will greatly facilitate the extension of the results. In fact the end of the workshop discussion turned around how incorporate effectively the technologies developed in the project, as part of the tools that the State funds. In this respect the farmers requested more transfer of technology, but through a participatory model with local leadership and many more co-ordination between Institutions and institutional commitment to longer term. They also detected weaknesses in the training of technicians, the only way to ensure the adoption of the technologies. They also emphasized the need to evaluate the Economic and Social Impact of the soil conservation practices.

**5. Next steps**

The following next steps were agreed:

- The results and agreements are being sent to participants in the week from 5 to 9 December, 2011. The slides with the research results will be available on the website www.geam.cl
- In relation to the commitments undertaken to improve the dissemination of the results, it should be emphasized that the responsible of the National and Regional of the Soil l Conservation Program were present in the workshop (German Ruiz from SAG, David Aracena from INDAP). They engaged themselves to incorporate the technologies developed DESIRE project, to the Integrated System to Recovery Degraded Soils (ISRDS) in order to improve the management plans that are funded to farmers
- The Ministry of Agriculture of Chile, through the Agricultural and Livestock Service, committed to continue supporting research and transfer of technology in the Soil Conservation practices, once the DESIRE project has finished.