4 Land preparation for large-scale restoration

In degraded landscapes with a low or non-existent vegetation cover, water cannot be absorbed by the soil and is therefore lost in runoff or evaporation. Improvements to land preparation through water harvesting, retention and soil permeability are key to the success of both forestry and agricultural plantings in the Sahel. In drylands, soil and land preparation is crucial to retaining moisture and providing a better growing environment for the plants before planting. Two micro catchment systems based on the digging of microbasins to improve water retention are the most often used: (i) manual in agro-forestry or agro-ecology systems and (ii) mechanized using a tractor coupled with a special plough in wider agro- and sylvo-pastoral systems.

The traditional land preparation

Traditional micro catchment systems in the Sahel include the "half-moon", and the "Zai" or "Tassa". The traditional half-moon entails digging large planting pits (2-3 m wide) in the shape of a semi-circle and placing the excavated earth on the lower-side to form a contour bund so that during the rainy season, water does not run off the surface but soaks into the soil, thus allowing the vegetation to grow. Soil prepared in this way retains about 100 litres of rainwater per year and about 300 half-moons can be dug in one hectare of land. Organic fertilizers can also be used to improve soil by filling in the half-moon or Zaï holes with compost or manure. Such techniques are commonly used in agro-forestry or agro-ecology systems as they facilitate the restoration of degraded land and also increase soil fertility.

However, the traditional preparation of these micro-catchments by hand, with traditional machinery or animal traction is difficult, slow, and labor-intensive. Although effective, these practices are not compatible with the large-scale restoration objectives that have been set as a response to the tremendous amount of degraded land in the GGW core region, especially in the face of rapid climate change.

Mechanized land preparation

For a larger scale of land preparation (e.g. 50-200 hectares), mechanized deep ploughing is carried out using specialized Delfino ploughs, a concept inspired by the traditional methods of the Sahel described above. The plough digs deeper (50-80 cm), breaking the soil's hard crust and exposing the soil in a way that creates micro-dams/micro-catchments for better permeability and moisture retention (10 times more than the manual- about 1 000 litres per rainy season). It is pulled by a heavy-duty tractor (about 100 hp) on slopes with up to a 10 per cent inclination in areas with 200-600 mm annual precipitation.

The new generation of the Delfino ploughs facilitates the preparation of large surfaces of degraded land in a limited period of time. A tractor with a Delfino plough can work up to 15-20 hectares a day, creating about 500-700 micro catchments per hectare, comparatively, 100 workers would dig 1 hectare with about 300 micro-catchment a day.

Special training is needed for the tractor drivers so as to ensure that the half-moons are dug in the right direction (i.e. perpendicular to slopes) and that the existing vegetation is avoided and therefore not destroyed. It is equally important to plan for the maintenance of the tractor (mechanic, spare parts etc.), in fact, in addition to specialized ploughs the Delfino group has set up a specialized maintenance garage (after-sales service) as well as a training school in West Africa for mechanics and tractor drivers using this equipment. Some of the first and second generations of Delfino are still functional after 15 to 20 years in operation.

For monitoring and reporting purposes, it is important to record the polygons consistently by a GPS device in order to accurately identify/map the position and measure dimensions of the areas that have been ploughed. This will allow a follow up of biomass increases (vegetation index) after planting and to assess a success or failure of the interventions.

TABLE 3. Technical statistics/specifications of a Delfino plough unit

Land prepared per day	15 to 20 hectares
Average land prepared per year	1 000 to 1 250 hectares
Spacing between trenches	3 - 5 metres
Spacing between 2 micro-dams in a row	1 - 2 metres
Number of micro-dams in a row of 100 metres	12 half-moons in 100 metres
Dimensions of a half-moon/micro-catchment	Diametre: 0.90 - 1 metre Dept: 0.50 – 0.80 metre Long: 4 - 5 metres
Rainwater retention capacity	Up to 1 000 litres per season (remain moist up to 2 months after the rains)
Periods for ploughing	October to June (dry season before the rainfall)
Density of planting/sowing	600-1 000 nursery plants per hectare 2-3 kg of herbaceous seeds sowed directly

FIGURE 5. **Improvement of land preparation, comparing traditional and mechanised ploughing**

TRADITIONNAL	MECHANIZED
• **SLOW AND TAXING:** usually 1 hectare per day, with 100 person • **SOIL PREPARATION DEPTH:** up to 50 cm • **LOW INVESTMENT** (tools, labour) but per hectare cost is high	• **FAST:** 15 to 20 hectares per day, with a team of 2 drivers and 1 mechanic • **DEPTH:** up to 1m • **HIGH INITIAL INVESTMENT** (plough and tractor, but lower cost per hectare and cheaper in the long term)

KEY RECOMMENDATIONS
CHAPTER 4

Land preparation needs to be planned well in advance to ensure finalization before the start of the rainy season.	**Mechanized land preparation allows for the restoration of large surfaces in a shorter period of time, making it more feasible to respond to huge demands for restoration needs.**	**To be economically viable, mechanized site preparation needs to be carried out on large portions of land (e.g. 50 to 200 ha).**

WOMEN PLANTING TREE SEEDLINGS IN GARGABOULE'S RESTORATION PLOT, AAD PROJECT, DJIBO, BURKINA FASO