Sand Dune Stabilization

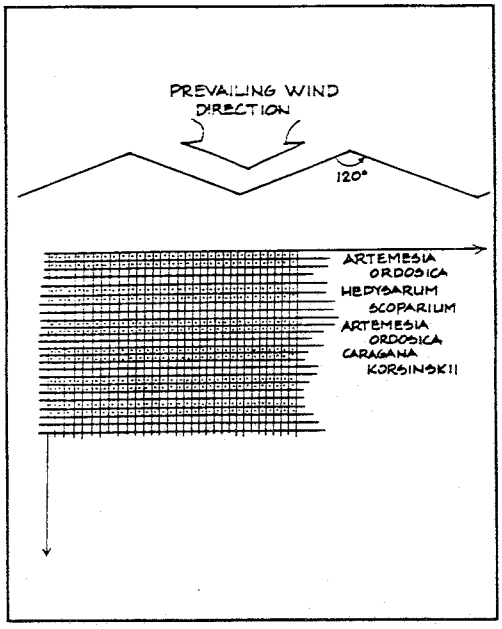
by Carl Wachtmeister

In the southern part of Zhongwei county, China, at the Shapotou Research Station, ambitious and innovative efforts have been taking place to hold back the encroaching desert, and even to create topsoil and arable land on the fringes of the Tengger Desert. Centuries of overgrazing and fuelwood collecting had caused ecological degradation in this land where the small margin of symbiosis between people and nature stands in such delicate balance.

This degradation threatened the livestock feed supply; reduced herds; caused sand encroachment into farmland, communities, and roads; and ultimately threatened indigenous populations with malnutrition.

Innovative efforts to combat sand encroachment, which amount to a kind of "dune stabilization," were implemented cooperatively by farmers and scientists using local labor and materials. Their method has implications in desertified areas of the U.S., as well as for residents of the Middle East, Africa, and Australia, and all other places where large population centers are living on the borders of desert areas.

In China, sand dune stabilization is undertaken to protect an area of economic value, such as cultivated land, roads and communities, from sand encroachment. To stabilize the dunes, a design of windbreaks and straw grid barriers coupled with a diversity of native xerophytes has been developed. The design makes use of airborne dust blowing across the project, local resources of straw surplus, corn stalks, and wood, and native shrubs propagated in local nurseries



Left: *Bird's eye view of windbreak sheltering straw grid barriers. Each 1 m x 1 m square acts as a runoff catchment.*

Below: *Cross section of stabilization system.*

Step 1: Define prevailing wind direction and the direction of sand encroachment throughout the year.

Step 2: Set up windbreaks 300 meters from the area to be protected, at the top of a dune ridge. They should be 1.5 meters high, 60% permeable to wind, and zigzagged at a 120 degree angle both toward and perpendicular to the prevailing wind direction. The windbreaks increase the height and mass and reduce the moving speed of the dune, and reduce the wind velocity close to the ground above the straw grid barriers.

Step 3: Make straw grid barriers halfway up the next dune's windward slope, using available straw. Place the straw upright in the sand in parallel lines 1 meter apart. Fold the straw over with a flat spade, forming a continuous barrier. Cross the barriers at a right angle, using the same procedure, but leave the cross points intact.

Step 4: In the 1 meter square of sand which results, push the sand from the center to the sides to form a rainwater catchment basin. As well as collecting rainwater, the basin will stabilize the sand and prevent sand and water erosion.

Step 5: Plant with native species of varying heights. Three species of shrubs native to the Tengger Desert have been used

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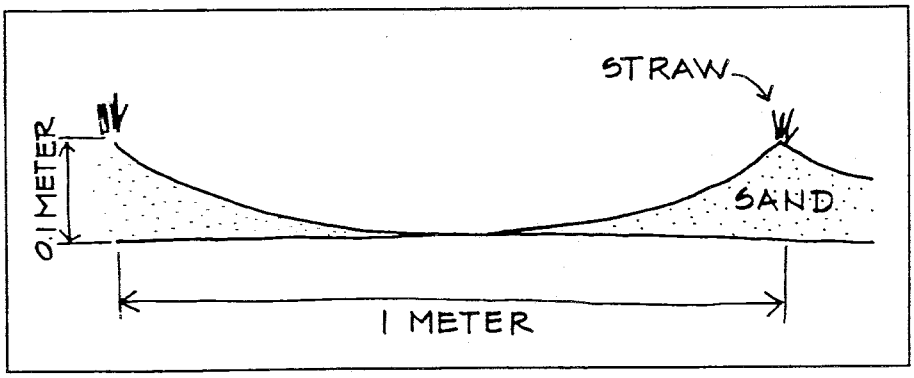

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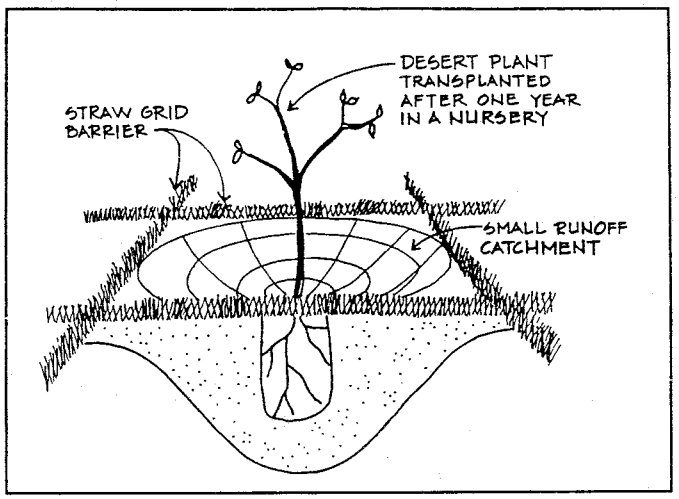
successfully in Shapotou: *Artemisia ordosica* (a low subshrub), *Caragana korsinskii*, and *Hedysarum scoparium* (both high leguminous bushes.) They are transplanted in the cool and rainy season after one year in a nursery. Each species is planted in separate double rows which are perpendicular to the prevailing winds. Each plant is placed at the bottom of the catchment, 1 meter apart. Each planted double row is separateed by an empty double row. Rows of taller species are alternated with rows of lower species.

The windbreaks build up a high dune with larger mass and reduced speed. They also protect the reclaimed area from direct, strong winds. The windbreaks, the straw grid barriers, and the alternating shrub heights create turbulence as the wind passes over the reclamation area. The turbulence causes dust to settle over the reclamation area. It mixes with microorganisms and wilted plant leaves on the surface of the catchment basins, forming a microphytic crust of bluegreen algaes, lichens, different minerals of different particle fractions, and humus. Eventually, topsoil is formed *[See PDJ #10, p.4 for more on microphytic crusts.]*



Profile of an individual runoff catchment formed by the straw grid barrier.

Illustrations: Silvia Rayces from drawings by Carl Wachtmeister

At Shapotou, 5 to 10 cm of topsoil has formed since 1959 when the first plantation was created. ◆