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ReviTec®, a modular approach of ecological restoration to combat degradation and desertification

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ReviTec® is an ecological rehabilitation technology developed by the Bremen-based partnership corporation KeKo (Kesel, Koehler & Associates Biologists) in co-operation with the Center for Environmental Research and Technology (UFT) of the University of Bremen. It aims at combating degradation and desertification by the re-establishment of site-specific ecosystems with their peculiar ecosystem services. This is achieved by erosion control, substrate management and fostering of site specific biodiversity. The measures include soil and water conservation, restoration of degraded and polluted soil and ecological afforestation.

The ReviTec® approach focuses at the initiation and acceleration of ecological succession (conservation in a dynamic sense) with a mosaic-type exposure of a special substrate mixture which may be filled in biodegradable bags for erosion control. The substrate consists of soil (e.g., excavation materials) and composts enhanced with locally available amendments to improve water holding capacity and nutrient status. Bio-activation with site-specific soil biota is important, including mycorrhizal fungi. Purposive sowing and planting of target and nurse plants complete the activation. The ReviTec® bags can be exposed flexibly to the topography and modularly arranged to structures, such as small islands, bunds, half-moons, etc. These micro-topographies provide safe sites for natural colonization and function as collectors for sediment, water, and biota, and subsequently disperse these to the surrounding. In afforestation, the islands additionally provide support and service for the planted target trees and nurse plants. The reduction of soil erosion combats land degradation and the water harvesting features will lead to long-term improvements of water availability.

The ReviTec® -approach is in line with the Ecosystem Approach of the UNCBD, follows the principles of the UNCCD and the guidelines for good restoration practice, published in 2004 by the SERI and IUCN. It incorporates biological and environmental spatial variation into the design, allows for linkages within the larger landscape, emphasizes process repair over structural replacement, allows sufficient time for self-generating processes to resume, treats the causes rather than the symptoms of degradation, and includes monitoring protocols to allow for adaptive management. As required by the ecosystem approach, ReviTec® is designed for adaptive management not only to deal with the complex and dynamic, non-linear nature of ecosystems as known from our long-term experience on ecological succession, but also to deal with the specific requirements of the locality in focus. This is possible by the modular, low-tech nature of ReviTec® .

We recently have demonstrated ReviTec® in various applications derived from best practices of Soil and Water Conservation measures at the “Revital” demonstration and research site of the University of Bremen (http://www.uft.uni-bremen.de/Revitalisierung/profil.html). The project is supported by the Senate of Bremen, involves local industry and includes a gender study on the acceptance of ReviTec® in a gardening project in Hentjesbay, Namibia.
The pilot study MedOak (http://www.medoak.de) aims at the re-establishment of a Quercus ilex woodland in semi-arid Mediterranean wildfire areas in Majorca/Spain. Four years after two large wildfires had destroyed all Pinus halepensis macchia in 1991 and 1993, we installed

the MedOak research area of about 1000 sqm in the Na Burguesa mountains near Bendinat at 300 m a.s.l. and with 350 mm mean annual rainfall. With support of the municipality of Calvià and of a private enterprise we could fence the area against grazing and implement different series of experiments to improve the ReviTec® technology. These experiments and its main results are assembled in the table.

Tab.: Survival and growth rates of Quercus ilex in different applications of ReviTec® measures in the MedOak-Bendinat project.

application	planting series	in bag	in planting pit	planted number	survival rate [%] until April 2006	growth rate per year [%]
commercialized saplings	1997, 1999	X		84	2,4	-2,6
bedded acorns	2000	X		136	11,0	3,5
bio-activation	1999, 2001	X		59	37,3	**20,8**
bio-activation and inoculation	2001	X		29	**72,4**	**18,2**
bio-activation	1999, 2002		X	155	38,7	5,4
bio-activation and inoculation	2002		X	83	**81,9**	13,5

We achieved the best result of about 80% of survival of the drought periods with Quercus ilex saplings grown from autochthonous acorns in nursery substrate bio-activated with a small amount of soil from Majorcan oak woodlands and inoculated with ecto-mycorrhiza. We cultivated these symbionts from autochthonous fungi, which we bedded out in bio-activated substrate bags or planting pits exposed in the shade of existing shrubs. Best growth rate of about 20% was recorded in bio-activated bags. Microclimate measurements show that the bags mitigate temperatures and provide higher air humidity and more dew fall events, particularly when we cover the bags with whitish limestone pebbles from the area. In 1997, we also planted Pinus halepensis saplings which (together with spontaneous Pines) now have grown to a copse which will give beneficial shade to the holm oaks. We successfully could initiate the development of an oak woodland.

The experience we have gained in 9 years of experiments at Majorca, in the recent demonstration and research site in Bremen/Germany, and in the gender study in Namibia are the background for projects for larger restoration of Mediterranean oak woodland in the Bendinat area and for projects of soil and water conservation and erosion control in degraded areas, e.g., in Africa and China. ReviTec® is a complementary measure for conventional practice to cope with difficult and extraordinary conditions. The cost is higher than for mere afforestations and in-between forestry measures and geotextile applications and depends on the availability of regional resources.