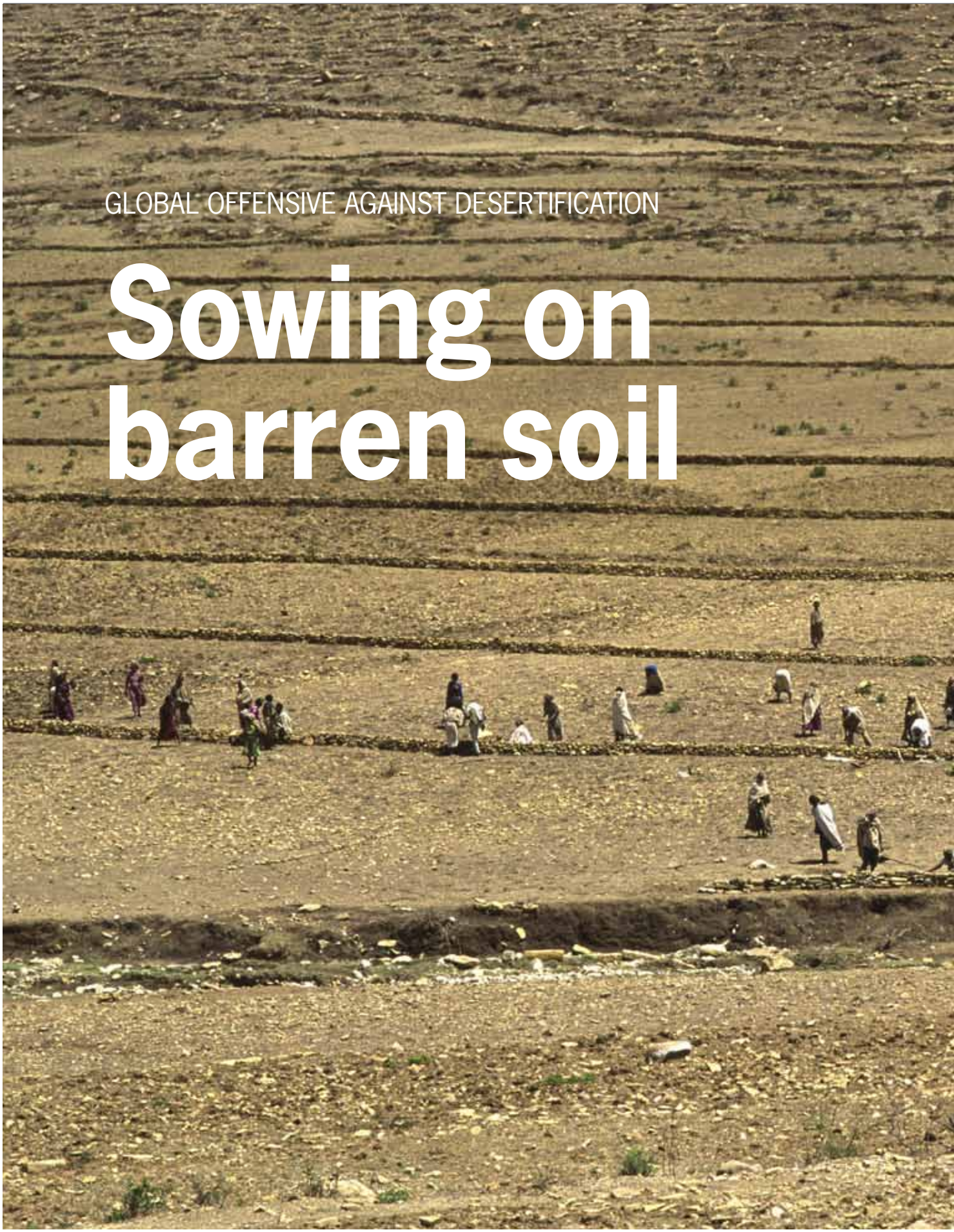


GLOBAL OFFENSIVE AGAINST DESERTIFICATION

Sowing on barren soil

In efforts to keep desertification at bay, there has been a lot of experimentation in recent years with land restoration methods and new forms of land use. This has generated a wealth of strategies which have benefited local populations as well. 'The approach used by farmers in Cambodia is now available to policymakers in Peru.'

TEXT MARION DE BOO **PHOTOGRAPHY** LINEAIR **ILLUSTRATION** JENNY VAN DRIEL

Villagers in Ethiopia create terraces in order to prevent soil erosion.

A dry and dusty savannah, Emaciated cattle plodding dejectedly past the last remaining scraps of grass that have survived the merciless heat and sandstorms. Such images are all too familiar. Across the globe, soil degradation and desertification cost about 490 billion euros per year, according to expert estimates. 'About 12 million hectares of land are lost to this every year,' says Wageningen soil physicist Coen Ritsema of Alterra Wageningen UR. 'That is equivalent to half the land surface of the UK.'

Desertification takes hold for a number of reasons. Soils can be damaged by water and wind erosion, salinization, overgrazing, drought and forest fires. Forest fires alone send a surface area the size of India and Pakistan up in flames every year. Sometimes the forest comes back afterwards. But if forest fires and periods of drought follow close on each other's heels, the soils and the stock of seeds they harbour become exhausted. In the end nothing grows there anymore and the land is irretrievably lost.

The international project DESIRE is studying the options for more sustainable land use under dry conditions. DESIRE stands for Desertification Mitigation and Remediation of Land. An international team of scientists working in the project has tested all sorts of soil management measures from all around the earth. 'We wanted to identify the best approaches for various different parts of the world under constantly changing conditions,' says Ritsema. As project leader, he led the collaboration between 26 partners from 13 countries. Experiments with new forms of land use and restoration methods were carried out at 17 designated hotspots known for severe desertification and soil degradation. This cost almost 9 million euros, about 7 million of which came from European Union coffers, with the governments of France, Italy, Spain, Mexico and the Netherlands contributing the rest.

The project's harvest consists of a book (*Desire for Greener Land*), the web portal www.desire-his.eu, dozens of scientific publications, several films, posters and pamphlets intended for local farmers, policymakers or the general public, and above all a large database with internationally validated methods and techniques for making life better for people living in arid zones. Globally, there are 1.5 billion of them. 'Most of them are poor,' says Ritzema. 'Soil restoration means poverty alleviation. People need to be able to survive sustainably in arid zones. They might be able to carry on for another 20 years with bad irrigation systems, but after that you are left with a saline desert.'

DEEP PLOUGHING IN CHILE

One of DESIRE's hotspots is in the hot, dry Cauquenes district in the interior of Chile. Farmers here watched their harvests steadily diminish due to soil exhaustion and the loss of fertile soil to surface runoff. Alternative farming methods are therefore being studied. For example, a well-thought-out crop rotation of vegetables and grains, combined with grazing, leads to more organic nitrogen fixing. This has the added advantage of saving poor farmers 50 to 80 percent on their usual expenditure on nitrogen fertilizer.

Another revelation among the results is that a combination of deep ploughing followed by five years without ploughing creates the optimal moisture balance in the soil for grain cultivation, with minimal runoff of rainwater. One disadvantage of these alternative methods is that the farmers have to hire machines to do the deep ploughing, but their investment pays for itself with a better harvest. 'These experiments were extensively discussed by the farmer organizations involved,' explains Ritsema. 'On field days, about 600 farmers learned about the new methods and other projects coming out of DESIRE.' The fieldwork was done by one of the research centres of the Chilean ministry of agriculture's research institute INIA. 'Tragically enough, the area was then hit by a major earthquake and our partner's laboratory collapsed,' says Ritsema. 'After that the project was suspended, as the Chileans had other things on their minds. But eventually we were able to finish off the work properly.'

In the hotspot in the central Portuguese region of Leira, about 50 forest owners are experimenting with better forest management measures, with the help of the University of Aveira. In Mediterranean areas with hot, dry summers, forest fires are a serious threat to the soils. Rural Portuguese communities are affected by this year in, year out. 'Portugal has to cope with about 50,000 forest fires a year. They reach the suburbs of the big cities such as Coimbra,' says Ritsema.

The problem started in the nineteen sixties, when small farmers in dry, mountainous areas were driven out of business by large-scale, mechanized competitors elsewhere in Europe. They gave up their farms and moved away, and the abandoned farmland soon became overgrown with bush. 'If those vast expanses of scrub and other flammable material catch fire, you get big fires,' says Ritsema. A forest fire is not a bad thing in itself, as the forest can recover from it. But if there are repeated fires, the seed supply in the soil becomes depleted. Trees and shrubs no longer recover, the bare soil is exposed to erosion, fertile soil gets washed away down the slopes into the valleys and the whole ecosystem ends up degraded. Farmers can no longer work the land, and they cannot make a living from forestry either. What is more, people who have gone to live in the big cities are afraid to come back to their old villages on holiday for fear of forest fires. Like this, entire districts become depopulated and houses are left to go to ruins.

Ritsema estimates that 90 to 95 percent of the forest fires are started by people, deliberately or otherwise. 'Preventive burning of strips of undergrowth in the spring can help to prevent summer fires.' Besides arguing for a change of approach in forest management, the researchers also propose some spatial planning measures. Villages should not be surrounded by thick forest, and there should be at least three escape routes for their residents.

GOING TO BED HUNGRY

There is an urgent need to combat desertification in order to improve food security. The United Nations expects the world population to increase from 7 to 9 billion people in the next decade or two. One in seven human beings still go to bed hungry.

Nowadays, many developing countries have a growing middle class of eager consumers. It is estimated that world food production needs to increase by about 70 percent by 2050 if it is to keep pace with the growing demand. This growing demand makes the problem of soil degradation even more pressing.

According to UN figures, the land surface that is unusable due to desertification has

‘Soil restoration means poverty alleviation’

Working the land in a dry, erosion-prone part of Hanamerant, Ethiopia.

doubled in 25 years. Population growth is putting increasing pressure on ecosystems and the number of arid zones is also on the increase in some parts of the world, due to galloping climate change. There are now about 250 million people in more than 10 percent of all the arid zones suffering directly from the effects of desertification. If the problem worsens it will affect one billion people in more than 100 countries. And most of these people are from the poorest and most marginalized sectors of society.

FIREWOOD

The experiments carried out within DESIRE are tremendously varied. In Botswana, for instance, a biogas plant has been built in which cow dung and organic waste from schools is digested, as an alternative to chopping down trees for firewood. Because the more people have a motor scooter or a car, the further into the bush they go to get firewood – a trend which aggravates deforestation. Trees and shrubs are important for curbing wind erosion and sandstorms and retaining moisture in the soil, all the more when the landscape is already prone to overgrazing. Biogas production is proving a good alternative to firewood.

Greek farmers face problems of a different nature. In the Greek Nestos Delta, close to the sea, the groundwater is highly salinated. Irrigation with that water brings so much salt into the topsoil that eventually nothing will grow anymore. Farmers there will have to switch to irrigation with fresh surface water.

In Mexico, soil fertility is deteriorating due to an inappropriate cultivation system. The standard practice of following a year of growing maize with a year when the land lies fallow causes a lot of runoff and water erosion on the vulnerable slopes. Field tests showed the farmers that they should always keep the slopes covered in the rainy season. The traditional combination of maize, beans and courgettes appeared to be the best way of doing this.

GOATS IN SHEDS

An example of a pro-active, not to say authoritarian approach can be seen in China. Fifteen years ago, the loess regions of North China faced massive erosion problems. During heavy rain, the water surged down the steep slopes, carrying masses of fertile loess soil into the river below. Since then, the Chinese government issued a decree. Goats were no longer allowed to graze. The slopes are now amazingly green again. The goats are kept in sheds and the local people have a good income.

‘In some places the Chinese have even built concrete terraces on the slopes to hold back the water erosion,’ says DESIRE expert Godert van Lynden. ‘When we asked during an excursion what this approach had cost and what the farmers were expected to gain from it, our partners did some hasty calculations and got the shock of their lives. Because concrete terraces cost a fortune. They had never looked at it in that light.’

Van Lynden works for the Wageningen institute ISRIC (World Soil Information). Within DESIRE, ISRIC was responsible for describing the environmental and socio-economic conditions at all the project locations. ISRIC also played a big role in the development of prevention and restoration methods. For example, Van Lynden did a lot of fieldwork at the hotspot in Morocco, where erosion is combatted by planting bushy crops along the slopes (*Atriplex*, also known as saltbush or desert holly). ‘During a downpour, raindrops do not hit the ground as hard and the roots hold the soil together so that less of it gets swept down the hill. It seems to work well. Another successful measure is to plant strips of grass along the contour lines to make sure the water does not run downhill and carry off the soil. ISRIC has explained the underlying causes of soil degradation and charted the conservation measures used. It is possible to measure exactly how much soil and >

water comes down both with and without these measures in place. A continuous strip of grass seems to work very well.'

BIOFUEL CROPS

According to ISRIC's director Prem Bindraban, it is very important to start using natural resources more sensibly and combatting soil degradation. 'The value of land and water is underestimated by many scientific calculation models and that leads to inappropriate use. You can see that in the calculations of the benefits of growing biofuel crops. In Brazil it seems to be lucrative to grow more and more soya, but economic calculation models do not take soil degradation and the loss of biodiversity into account.' Due to deteriorating soil fertility, global food production is slowing – according to some estimate by as much as one quarter. 'But these kinds of analysis are surrounded by uncertainties,' says Bindraban. 'That is why it is so important to document the soil degradation at the local level.' This is being done in the WOCAT (World Overview of Conservation Approaches and Technologies) database, the work of an international network of knowledge institutions – including ISRIC – and government bodies. The experiments at DESIRE's hotspots are documented in line with the methodology adopted by WOCAT.

LESSONS LEARNED

DESIRE has learned a few important lessons, says Ritsema. Restoration measures for already degraded soil always work out as costlier than taking steps to prevent the degradation in the first place. 'The costs of rehabilitating a completely overexploited area and restoring ecosystem services such as rivers full of fish and clean drinking water, are usually so enormous that you are better off spending the money on preventing the problems somewhere else,' says Ritsema.
Once the degradation is under way, it is more sensible to spend the available budget on damage limitation around the edges of the area than on trying to restore the central zone. In this context it is vitally important to first establish the precise cause of the desertification. Is it water erosion, loss of vegetation or salination?
In view of all this, the newly published book *Desire for Greener Land* is certainly not a cookbook offering instant recipes for success. Ritsema: 'Our database now contains about 400 strategies from all around the world. The approach of farmers in Cambodia is now available to policymakers in Peru. The trick is to find the strategies which you can also use elsewhere. But the investments do need to deliver benefits both in the short and the long term. So we have done our best to figure out the costs of the measures and the

COMBATTING LAND DEGRADATION

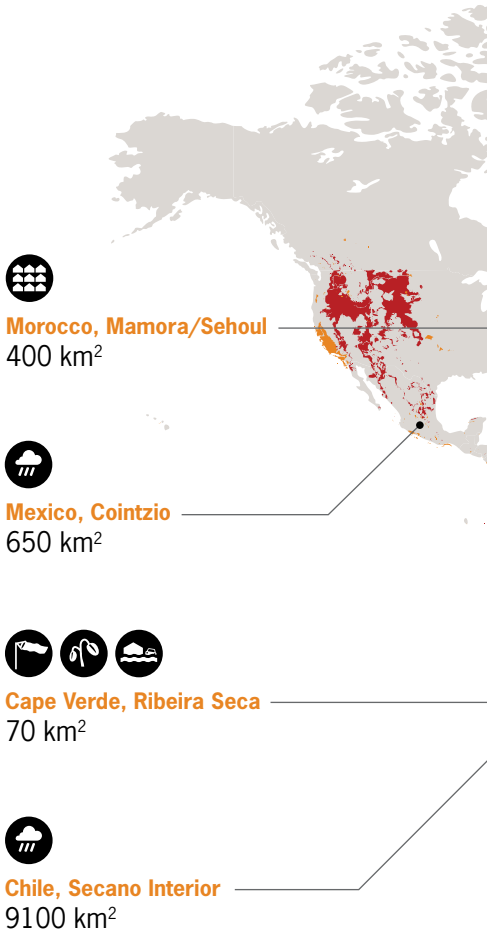
Worldwide, more than 1.2 billion hectares of cultivable land have fallen prey to desertification and degradation since 1945. In the DESIRE project, strategies have been developed for preventing further loss of land in 16 problem areas. These strategies can be used in comparable areas elsewhere.

Degradation-prone areas

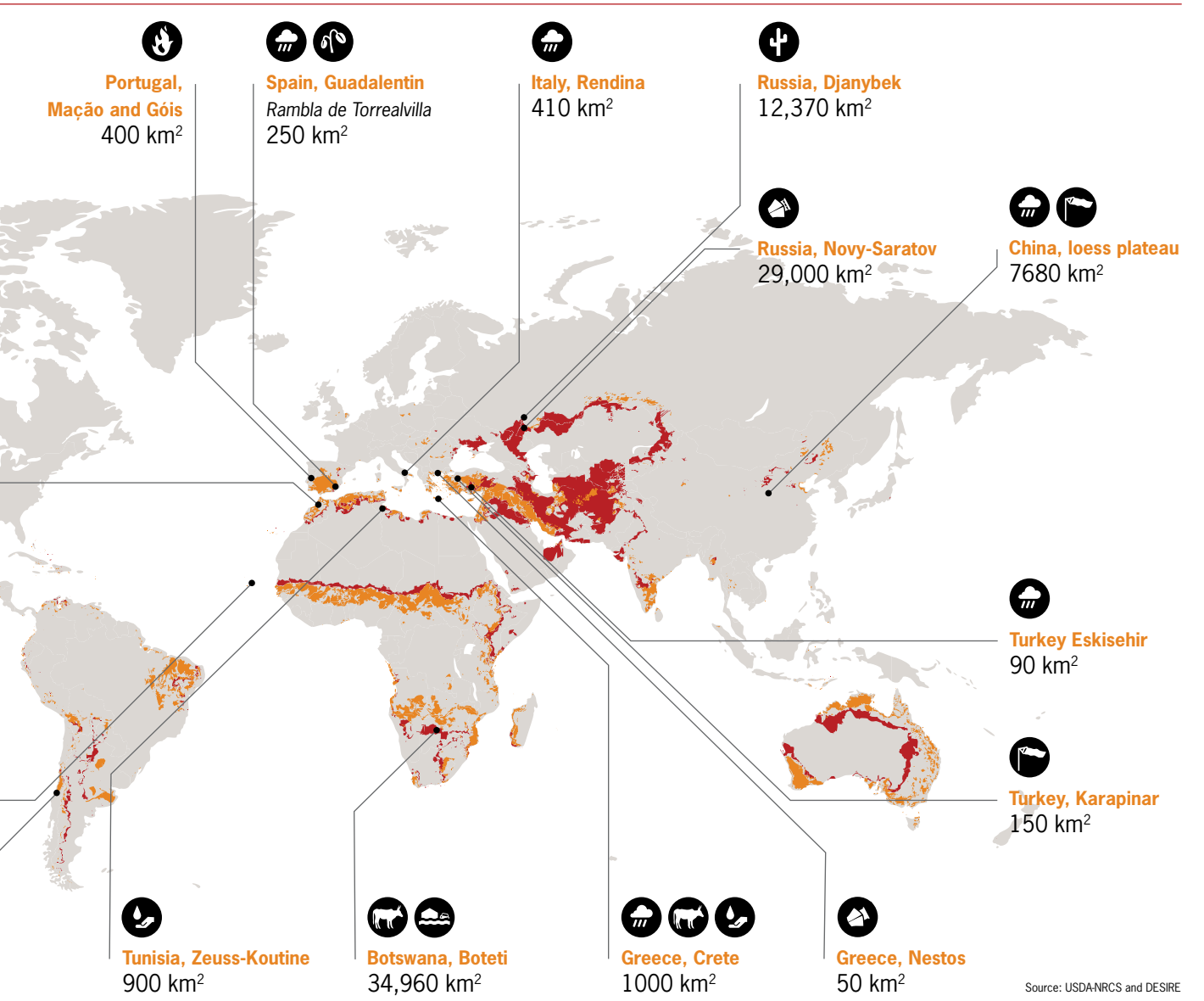
- Vulnerable
- Highly vulnerable

Main problems:

- Soil erosion caused by water
- Water stress
- Floods
- Limited vegetation growth
- Drought
- Salination
- Soil erosion caused by wind
- Forest fires
- Overgrazing
- Urbanization



'Forest fires send a surface area the size of India and Pakistan up in flames every year'



expected revenues. Our models include soil and water processes as well as socio-economic aspects. Precisely that broad approach was a very important bit of Wageningen input into this international project.'

The studies offer policymakers wanting to 'green' an area insight into which kinds of intervention theoretically deliver which benefits, and under what conditions. Ritsema: 'In what condition is the area? What are the costs of interventions such as creating terraces on steep slopes? How do they benefit the farmers after five, ten or twenty five years? Is it worth the effort? Do you get better harvests, less salination, less erosion, or cleaner river water with larger fish stocks? Or would it be better to spend your money some other way? We tried to encapsulate all our knowledge in calculation rules. But without dialogue with the local population, projects are doomed to failure.' ■

Info: www.desire-project.eu; www.isric.org and www.wocat.net.

Watch the film:
'The DESIRE project - the challenge and the results'