



**DARCA** (Desertification and Regeneration: Modelling the Impact of Market Reforms on Central Asian Rangelands) is a collaborative international research project, coordinated by the Macaulay Institute (UK) with partner Institutes in Kazakhstan, Turkmenistan, Belgium and France. The project began in 2000 and will continue for three and a half years.

## BACKGROUND

Dry rangelands cover over two thirds of Central Asia. At two sites in Kazakhstan and two in Turkmenistan, research is being carried out on recent shifts in the degree and location of rangeland desertification caused by animals grazing.



1. Central Asian satellite image showing rangelands in brown. Study sites are marked in red.

**DARCA** will contribute to policy on environmentally sustainable and profitable pastoral livestock production. In the past decade, the former Soviet countries of Central Asia have introduced market economies and dissolved the state collective farms.



2. Livestock at well in the Karakum desert, Turkmenistan

Livestock owners now decide how many animals to keep, what to feed them and where to move them. New systems of animal husbandry are resulting in different patterns of rangeland use, degradation and recovery from the Soviet period. **DARCA** aims to predict the environmental impact of these new patterns.



3. Shepherds in mountain pastures, Kazakhstan

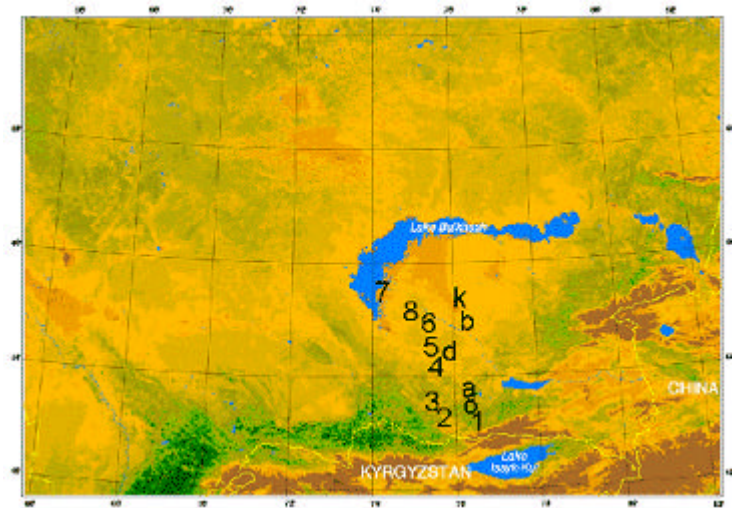
DARCA will also consider effects of policies, and identify improved management options for newly-privatised livestock owners.

### RESEARCH ACTIVITIES

- *Remote-sensed vegetation assessments*

Satellite imagery is used to trace the effects of climate and range use on vegetation. AVHRR-NDVI (Advanced Very High Resolution Radiometry - Normalized Difference Vegetation Index) is compared with ground-based assessments of vegetation condition to:

- Trace long-term trends in biomass and changes in vegetation composition
- Estimate current livestock carrying capacities in selected grazing areas
- Evaluate the severity of rangeland degradation
- Identify regions where vegetation degradation or recovery is underway.



4. AVHRR-NDVI satellite image of Lake Balkash basin, Kazakhstan study site

- *Ground-based vegetation assessments*



These provide information on forage availability and degradation around settlements. Biomass data is being collected along 10-15 km transects radiating from water points and settlements at the study sites, four times each year. The occurrence of different plant species is recorded in the field and samples of vegetation cut and analysed in the laboratory.

5. Scientists measuring pasture plants, Bayram Ali, Turkmenistan

- *Flock nutrition and performance studies*

The response of sheep and goat flocks to alternative feeding systems is being monitored in flock nutrition and performance studies. In each study area 20 flocks representing a range of sizes and management systems are being monitored four key times per year - around mating in autumn, in winter, after lambing and in mid-summer. Direct measurements are also made on the liveweight and body condition of sheep in the monitored flocks. Samples of fodder will be collected and analysed in the laboratory.



6. Scientists weighing sheep in Betpak Dalla desert, Kazakstan

- *Economic analysis of pastoral enterprises*

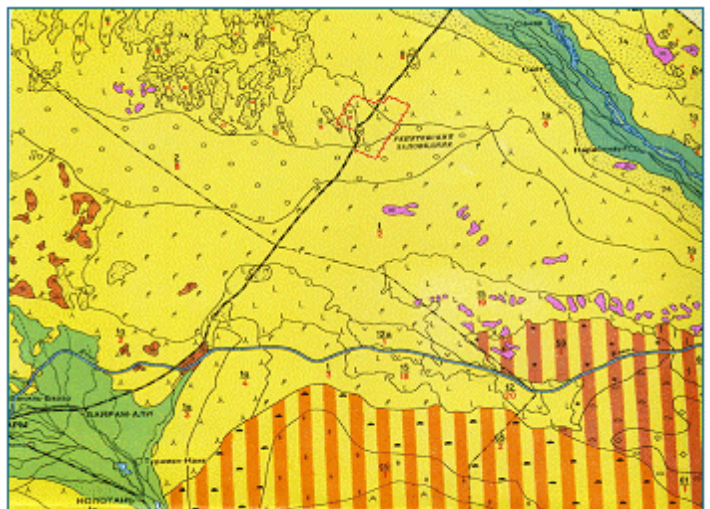


Household surveys are collecting data on the profitability of different livestock feeding systems, from the households that manage the same flocks monitored for flock nutrition and performance. This data will be used to assess the financial capacity of shepherds to adopt new husbandry practices. Households will be surveyed four times each year.

7. Interviewing a shepherd, Moinkum desert, Kazakstan

- *Land tenure and land use studies*

Land tenure and use studies will analyse the impact of new systems of land ownership on range use and flock movement. Livestock-owning households will be interviewed at each study site on their seasonal flock movements. Official statistics on stock numbers and performance, and maps and records of land ownership will be collected. Government authorities responsible for land registration will be interviewed.



8. Pasture types in Bayram Ali study area, Turkmenistan

- **Participatory videos**



Community groups in the study areas are shown how to make their own videos to communicate their views and practices of rangeland and livestock management under recent conditions of change. National scientists participate, allowing discussion of the research methods and goals with community members.

9. Shepherd boy in desert filming village women making wool rug, Turkmenistan

- **Dissemination of results, support for Central Asian research institutes and scientists**

Results will be published in scientific papers, popular media brochures and at conference presentations. National policy-makers and representatives of international donor agencies will discuss the results at meetings in Ashgabad and Almaty. The project is providing scientific and field equipment, as well as training, to partner Central Asia institutes. National scientists will have opportunities to learn from international study tours and attend international conferences.



10. Innovation after reforms: Shepherds in the desert cannot afford motor transport and have developed a camel bus to transport children to school (Kazakhstan)

- **Integration and modelling of project results**

All data will be combined in a computerised model that predicts degradation trends in response to changes in government regulations, market prices, climate and animal stocking density. The model is intended to:

- Identify optimal stocking rates and systems of flock movement in the study areas
- Predict the impact of changing a range of factors (such as government regulations, livestock prices, input costs, stock numbers, etc.) on pasture use and degradation
- Recommend ways to improve pasture use and shepherd incomes.

Modelling will take place after fieldwork is complete.

## PARTNER INSTITUTIONS, TEAM LEADERS AND (PARTICIPATING SCIENTISTS)

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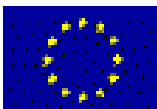
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