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570915:
*****EXCLUSIVE*****
CROP GENE
DETECTIVES,
ARMENIA

[View Caption..](#)



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AGRICULTURE'S INDIANA JONES HUNT FOR LOST CROPS

While a two or three degree increase in average temperatures, caused by global warming, may be perceived by people as merely a comfort issue, the chilling fact not widely appreciated is that a fraction of a degree change can be enough to stop many plants from flowering and delivering grains and fruits – our food.

And so we find real 'Indiana Jones' characters risking minefields, territorial conflicts and lawlessness in the Caucasus and Central Asia in a search among wild grasses (and among old seed stocks kept on farms, sometimes for generations) for the genetic robustness that has been bred out of crops in the course of 5000 years of farming to make way for other traits such as higher yields or whiter bread dough.

“We are going back through time, backwards through man-made evolution ... we are looking for the grasses that were used for bread-making thousands of years ago, at the start of civilisation when people first saw that keeping and sowing seeds from the best plants gradually improved what they were harvesting.”

This is a strong, fascinating story of universal relevance; a rare look at the sort of frontier work that is being done to keep bread on the table – figuratively and literally speaking.

The urgency of global warming scenarios is beginning to register with people, but a global hot house could be just part of a wider environmental collapse, the prospect of which is sending agricultural scientists back into early human history in a search for answers.

The farmer's tanned, furrowed, face is thoughtful. “You should ask the old women,” he

says after a pause. He smiles apologetically; dull veins of gold in his teeth. From village to village, farm to farm, others agree. “Ask the old women.” They are helpful and nostalgic, and after an obligatory vodka or two, melancholic.

We are on a mission that they understand. They are farmers – in the land where farming began.

So we start calling out the old women, who emerge from lightless kitchens and farm buildings – reliable electricity also just a memory – and we explain our quest. They hurry away and with extraordinary generosity re-emerge with tins, jars and knotted cloth containing biological treasures – the seeds of bygone crops.

Grains of wheat, barley, beans and peas disappear into small yellow envelopes, marked with the name of the village, the name of the family and, the GPS position – the handheld satellite positioning device an object of wonder to scores of children.

The old women wish us well. Some cry, because these visiting scientists seem to understand what they have known intuitively all along, that the traditional varieties were special – the same way other people lament the passing of tomatoes or apples that taste like ... tomatoes and apples before they started being grown for cold storage and mechanised handling.

There is a surrealism to these farmyard meetings, underscored by the dissonant chatter of Russian, Armenian and Australian accents as the team probes for knowledge of yesteryear crops, and asks for a little of the seed that might be hoarded. As we travel over rutted mountain roads we are also looking for places where ancestral plants might still grow on high plains that haven’t been over-grazed and, hopefully, haven’t been mined.

We are high in the mountains of southern Armenia, a stone’s throw from Iran to the south, and in sight of the disputed territory of Nagorno-Karabakh to the west, a smouldering fuse threatening to reignite a war between Christian Armenia and Muslim Azerbaijan.

This political and ethnic tension, not to mention the rusted metal detritus of the last flare-up, is the backdrop to a scientific mission that could determine the fate of millions of people; and their capacity in the years ahead to keep putting bread on the table –

figuratively and literally.

This is a hunt for genes; for lost genetic resources that agricultural scientists say will be crucial if the world is to keep feeding itself as climate change and deteriorating agricultural landscapes begin to bite.

And no one will be immune, least of all people who today know only how to buy food, not grow it.

And so this small band of genetic detectives is scouring the birthplace of agriculture, the Caucasus – Georgia, Armenia, Azerbaijan and parts of Russia – for remnant on-farm storages, and for ancestral wild grasses from which modern crops like wheat and barley were first bred some 5000 or so years ago.

The mission is led by Dr Ken Street, an Australian agricultural ecologist with the International Centre for Agricultural Research in Dry Areas (ICARDA) in Syria, and comprises leading Russian and Armenian plant researchers, as well as another Australian, Dr Clive Francis from the Centre for Legumes in Mediterranean Agriculture (CLIMA) in Perth. They might be on the far side of the world, but Australian agriculturalists and farmers are as desperate as any for crops that can withstand the tightening grip of droughts, frosts, saline soils, fungal diseases like rust and the spectre of global warming.

While a two or three degree increase in average temperatures may be perceived by people as merely a comfort issue, the chilling fact not widely appreciated is that a fraction of a degree change can be enough to stop many food plants from flowering and delivering grains and fruits – our food.

Added to this, modern crops have been pampered by aeons of farming and breeding for higher and higher yields, or for traits like whiter bread dough. Consequently a lot of the ‘toughness’ of earlier crop types has been whittled back as the genetic base has narrowed.

So it’s those genes that allow the old relatives of modern crops to still flourish in frozen or arid landscapes that need to be found and reintroduced. This is becoming an urgent race against time. It is the reason why we are now turning up unannounced at remote hamlets;

why we are blithely trampling over ground that later turns out to be marked on military maps as possible minefields, and why our little blue van keeps stopping and people jump out to gently collect seed from scraggy grasses with long Latin names.

“We are going back through time, backwards through man-made evolution,” explains Ken Street.

“We are looking for the grasses that were used for bread-making thousands of years ago – at the start of civilisation when people first saw that keeping and sowing seeds from the best plants gradually improved what they were harvesting.

“We are searching for what our far distant ancestors were using; not because they are better but because they have a wider genetic base. A modern wheat plant might have a few hundred parents, but the ancient varieties had hundreds of thousands, perhaps millions, of parents.”

The genetic diversity of the Caucasus, and the lure of discovery, is also what keeps pulling Clive Francis back to the region, long after he had intended retiring.

“This area is the birthplace of wheat, numerous fruits, vegetables like onions, and a lot of the world’s legumes ... not to mention scores of flowering plants such as tulips and gladioli,” he says.

Gazing across a meadow brimming with plant life; a wind-ruffled soup of botanic diversity, Clive Francis explains that there are 125 species of Astragalus alone in Armenia. Astragalus is part of the legume family – what most people know as peas, beans or lentils. Legumes are his passion and Armenia is Xanadu; a paradise of agricultural opportunity.

Legumes can transfer nitrogen from the atmosphere to the soil, and as such are a natural source of this vital plant nutrient. Legumes bred for sub-tropical environments have the potential to restore impoverished soils, particularly in the hunger-ravaged areas of Africa.

New legume varieties discovered on collecting missions such as this are taken first to ICARDA in Syria where they are planted and analysed. They are progressively assessed for various qualities in field trials and seed from the best offspring are eventually sent to

crop improvement centres around the world. By channelling new genetic material through ICARDA, a Future Harvest centre under the Consultative Group for International Agricultural Research (CGIAR) it remains freely available for 'public good' research.

Ken Street's collecting missions in countries such as Armenia, have now become part of an international program developed under the auspices of the new Global Crop Diversity Trust, set up in 2004 as an instrument of the International Treaty on Plant Genetic Resources for Food and Agriculture.

This work also involves trying to save, or rebuild, the once pre-eminent plant collections housed in the crumbling, neglected, botanical institutes of the former Soviet republics in central Asia and the Caucasus.

"The world is losing irreplaceable seed from these collections simply because the local people can't afford to replace water pumps, or stored seed is being eaten by mice. This is an absolute tragedy; doubly so because it is avoidable," says Street.

"The rate of deterioration is very advanced so we are desperately trying to collect, store, document and manage as much diversity from old varieties and wild relatives before they are gone forever. We don't know what challenges future farmers will face, but we do know the answers to those challenges are held in the genes of the plants we are collecting."

Ken Street's pursuit of botanical antiquity has dropped him into many tense situations, prompting colleagues around the world to dub him agriculture's 'Indiana Jones'. Repositories of ancient genetic resources tend to be located in remote, undisturbed pockets of often troubled parts of the world – meaning they are usually on the other side of minefields, battlefields or deep inside lawless terrain ruled by warlords and bandits.

But Street is a rugged and determined personality driven by a steely belief in his work. The son of philanthropic parents who built hospitals in Somalia and worked among Australian Aboriginal communities, Street has the same missionary zeal, except he is pedalling the temporal salvation offered by agricultural science.

"Before university I was a bit of a hippie and wanted to start a commune. When I researched the idea I realised that most communes failed, either because of politics or

from a lack of agricultural knowledge – so I went to university to study agriculture.

“Of course, I was idealistic and was soon disillusioned. It was very academic, while I just wanted to get my hands into soil.”

Street’s ‘search for meaning’ inevitably led to an interest in agricultural development and a PhD in agricultural ecology through ICARDA. Fifteen years later he still lives in the ancient citadel city of Aleppo, speaks Arabic, and spends as much time as funds allow in scouring the centre-of-origin for food crop species.

“The situations you find yourself in sound, but if you’re sensible, they are just a bit hairy and uncomfortable. The key is to understand the people and their history. You are in the middle of nowhere in Tajikistan, for example, where people have suffered over such a long period that they are brutal ... I mean, parents tell you how they were forced to watch their children being burned alive. So when a truckload of guys with guns arrive at your camp you know they are capable of doing anything. It gets tricky because telling them you are collecting grass seed is not the most plausible story they’ve heard.”

Most confrontations stem from economic desperation; the collapse of the Soviet Union has left its former southern republics littered with abandoned factories, collapsed infrastructure and town squares that 15 years later still steadily fill during the day with unemployed men with nothing to do.

The same economic break-down has ripped the heart from the region’s agricultural infrastructure, especially its once renowned herbariums, and seed collections.

“The agricultural research sector is basically bankrupt. So you’ve got all these ageing ex-Soviet scientists who are incredibly knowledgeable, dedicated and desperate to hand their knowledge to a younger generation. But young graduates end up in careers like tourism where a command of English alone is enough to qualify them for a reasonable job. No one is going to work in plant genetics. There’s no money in it and people have to live.”

For Dr Izabella Arevshatian, this internally-funded collecting mission in her own country is a rare opportunity for fieldwork. She and her colleagues at Armenia’s Institute of Botany in the capital Yerevan, have almost no sources of official support. Their government salaries

are US\$24 a month, from which they not only have to feed and clothe themselves, but also keep the institute running.

“It’s like it was in the war ... no water or electricity, but we saved the collection ... and that’s what we are doing again.”

But Dr Arevshatian and her colleagues, Professor Eleonora Gabrielian, the institute’s director, and Dr Estella Nazarora, are now old women. The determination that has kept them and their work alive through freezing winters and the crushing sense of apathy from outside can’t last.

Yet they are driven still by the vision of the institute’s founder Alexander Shelkovnikov and their student-days mentor, Professor Armen Takhtajian. These are famous names in international botany, but their once glorious institute is a worn-out building disappearing into an abandoned jungle that used to be the adjoining botanic gardens. That it functions at all is due solely to the extraordinary faith being kept by this small group of former students.

“Professor Takhtajian inspired in us the beauty of plants,” says Dr Arevshatian simply.

The inside is spartan and dusty, rooms overflowing with head-high piles of pressed plant specimens, brittle inside the pages of Soviet newspapers dating back to Stalin’s regime. There is not a single computer. The records of generations of scientists remain on paper cards in wooden filing cabinets. It is a treasure-trove of fragile, rare, botanical history.

“I am optimistic,” says Dr Arevshatian, because we have come through hard times before. “Sometimes politics tries to ignore, or destroy, science. But science always wins because science serves the people.”

In her upstairs office, Professor Gabrielian proudly displays a colour photograph of a rare flower, *Ornithogalum gabrielianae*, a new species discovered on Mount Aragatz, Armenia, in 1997 and named after her – the eleventh plant species to be named in her honour.

She is renowned in world botany, yet she sits in a small room stacked high with fading hope and memories. She is surrounded by her lifelong collection and the eleven weighty

monographs she has authored and published. It is a priceless repository but has no clear future or home when she and her septuagenarian colleagues die.

She opens her arms indicating the piles of newspapers that hide tens of thousands of dried, pressed, specimens: “Some of the most beautiful and rare wild plants on the planet are here,” she says. “And like all plants they hold crucial places in delicately balanced ecosystems. Some of these plants come from landscapes that swing from plus 40 to minus 40 degrees Celsius between summer and winter. It is vitally important to find out what plants like this can teach us.”

Eleonora Gabrielian has been collecting since she was a student in 1946. She met her husband, who worked alongside her for the next four decades until the winter of 1994. There was no heating at all that year; the year he died.

“Perhaps we are crazy,” says the Professor solemnly. “We are paid 74,000 drams (US\$24) a month and we each have to put in 20,000 drams for electricity. But botany is our life. It is the science of life and it keeps us going. Future generations will need this knowledge if they are to sustain the planet’s biodiversity ... but I am 76 years old and I need to be able to put what’s in my head into the heads of future generations.”

The lament is heartfelt and for younger scientists like Ken Street, it is a critical, global, issue: “In 10 years from now we are facing the prospect of this region having no trained agricultural scientists in germplasm conservation.

“This is frightening, because the genetic origins for a very large proportion of the world’s food crops do not exist anywhere else.”

This is why outsiders, like Street and Clive Francis, are playing significant global roles; with Street having been particularly influential in rallying international support for the Global Crop Diversity Trust.

In an age in which technology and globalisation have many people anxious about the origins of their ‘daily bread’ these researchers’ work may go part-way to restoring a sense of familiarity with our food and its farming credentials.

And for agricultural scientists generally, foraging for lost genes is a much-needed step to better matching the crops we grow with the landscapes we farm.

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Further Information:

<http://www.futureharvest.org/>

<http://www.ipgri.cgiar.org/Publications/1066/The%20global%20crops.pdf>

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