

Adapting to climate change

Mary Peart and Morgan Phillips



GeographyReviewExtras

For a presentation on climate-change response go to:
www.hoddereducation.co.uk/geographyreviewextras

Net Kumar Rai with one of three buffalo introduced by the charity. The buffalo move from farm to farm to breed stronger and healthier stock

An agricultural case study from Nepal

This case study looks at a project in rural Nepal, working with local farmers to reduce their vulnerability to climate change

Nepal, which lies in the Himalayas between China and India, is one of the world's poorest countries. It has a GDP per capita PPP of just \$2,500. With its

low level of development, predominantly rural population and widespread poverty, Nepal's carbon emissions are very low compared to those of the UK, as shown in Figure 1. But despite its minimal contribution to climate change, Nepal is suffering the impacts more than most. In its high-altitude, glaciated environment, where it is difficult at the best of times to eke out a living, the population is extremely vulnerable to shifting weather patterns. As crop yields fall, many people are forced to abandon the countryside and migrate to the over-crowded cities, or overseas, in search of work.

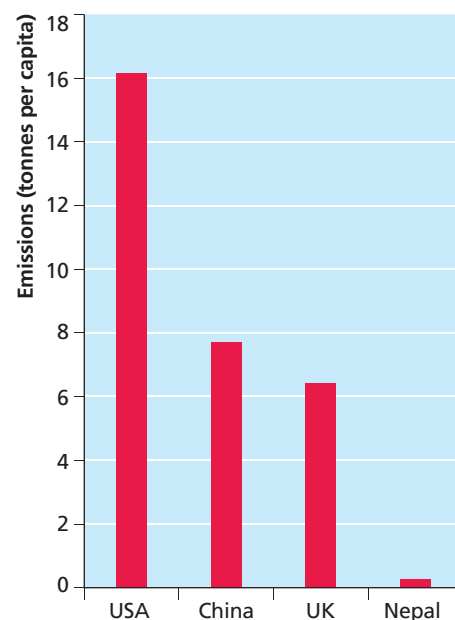


Figure 1 Carbon dioxide emissions per capita for selected countries, 2013

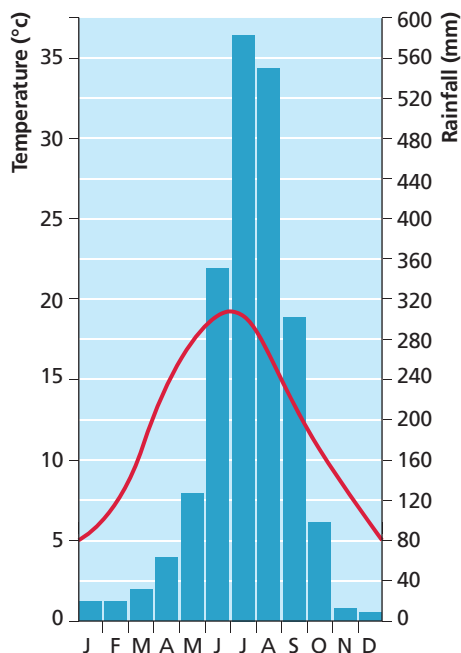


Figure 2 Climate graph for Salleri, the capital of Solukhumbu District, Nepal

Box 1

Data on climate change

It is difficult to give accurate figures for climate change in Nepal because:

- Data have only been collected since the 1960s.
- There are few monitoring stations throughout the country.
- The topography, with massive changes of altitude and deep valleys, leads to much local variation.

The impact of climate change

It is difficult to gather accurate figures for the extent of climate change in Nepal (Box 1), but models attempting to predict climate change match closely with the perceptions of farmers that the days are becoming hotter and that the pattern of the monsoon rains, shown in Figure 2, is changing.

Rainfall is decreasing and becoming more erratic, with more intense storms resulting in more water lost as runoff. This means that groundwater supplies often run dry before the start of the rainy season. It also leads to problems of landslides, erosion and increased sedimentation. Patterns of winds, fog and hailstorms are also changing.

As temperatures rise:

- snow cover, the primary source of irrigation for high-altitude farmers, is reduced
- melting of glaciers speeds up
- there is increased risk of forest fires

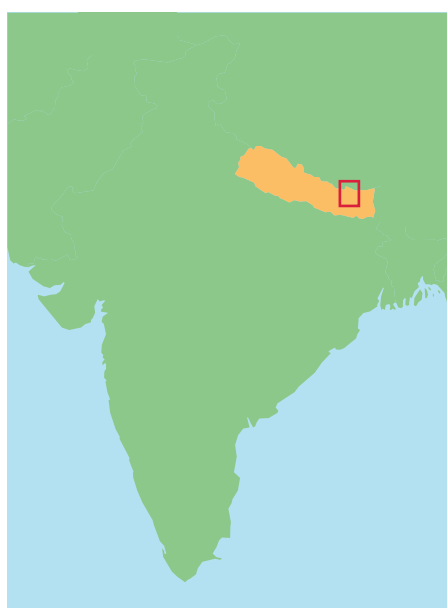


Figure 3 Map showing the location of Deusa

In addition, the changing climate has led to an influx of disruptive insect pests and **invasive species** such as the poisonous crofton weed (known locally as banmara) and the smut disease (kalo poke) which affects rice and maize. As a result, crop yields are declining and the problems of water shortage and food insecurity are becoming increasingly widespread and severe.

Community-led adaptation

To address these problems, and the resulting poverty and migration, the Agro Forestry Resources Centre (AFRC) was established at Deusa in the Solukhumbu District of Nepal (Figure 3). Subsistence farmers have traditionally grown staple crops of rice and maize, as well as millet, buckwheat and potatoes, on the rain-fed terraces of this middle hill region. This diet was supplemented by vegetables and fruit, including oranges and bananas, together with livestock husbandry.

It has become increasingly hard for farmers to maintain this way of life. Since it was established in 2012, the AFRC has provided training for farmers and helped them to integrate traditional methods with improved technologies so that they can adapt to the changing conditions.

Why this community?

The AFRC is a small-scale community-led project, supported by Eco Himal, a Nepal-based NGO, and funded by The Glacier Trust, a UK charity that promotes sustainable development programmes in response to climate change in Nepal. The AFRC was established in Deusa as the community had proved receptive to new developments. It had already benefited from Eco Himal projects:

- installing toilets, which ended defecation in the open
- introducing more efficient stoves, which reduced the quantity of firewood needed and cut smoke emissions, improving respiratory health

The Deusa community is proactive in seeking solutions to the impacts of climate change. To ensure the community retained ownership of the project, which is intended to become self-sustaining, The Glacier Trust did not provide all the start-up funds or running costs. Local farmers were required to invest in the project, each paying 100 Nepalese rupees (about £1) for initial membership and 50 rupees a year thereafter.

Setting up the project

An area of poor land was given to the AFRC by the community, and farmers contributed around 3,000 work days to build the centre and terrace the surrounding land in preparation for cultivation. In its sixth year,



Local farmers have been supported to set up polytunnels and grow crops out of season



the 304 farmers who are members of the AFRC are expected to contribute 1 day a year towards maintaining and cultivating the centre. An executive committee, including male and female representatives from all the wards in Deusa, is responsible for the planning and implementation of AFRC projects.

Climate-resilient arable farming

The work of the AFRC has many elements, providing holistic support for the farmers. Training at the centre is followed by site visits, offering advice specific to the farmer's needs. As traditional crops are yielding less, farmers are encouraged to develop kitchen gardens, growing a wider range of vegetables, including cabbages, courgettes and cauliflowers. Improved seeds and seedlings are made available and they are taught how best to grow the new and unfamiliar crops. This includes intercropping.

Intercropping

Tomatoes grow particularly well when planted among maize. They come into fruit after the maize has been harvested, increasing the output of the land. Other crops have been found to grow well together. Coffee, for example, grows well under bananas and bamboo, which provide shade. Intercropping with leguminous plants such as beans helps fix nitrogen in the soil. Such knowledge is shared among the farmers so they can maximise production.

Other initiatives

Mushroom growing, which requires little initial investment and produces a crop quickly, has been demonstrated at the AFRC. Low-cost polytunnels have been provided so that crops such as tomatoes and cabbages can be grown outside the normal growing season. By the end of 2017 the AFRC had three polytunnels and

selected local farmers had been supported to set up 13 of their own.

Farmers have received training in using compost, manure and liquid manure to maintain the fertility of the soil. This helps to ensure the continued productivity of the land. **Bio-intensive agriculture** has been introduced, to maximise yields from small plots of land. The improved output of the kitchen gardens means the farmers' families benefit from improved diets and they can sell any surplus at local markets.

Addressing water scarcity

The success of such initiatives depends on water being available for cultivation, and supplies of water in the region are becoming scarcer. The AFRC has introduced **water harvesting** using plastic ponds. Three ponds, each with a capacity of 60,000 litres, have been built to supply the project and for demonstration. There have since been many requests for technical assistance and construction materials from local farmers as they build their own ponds.

Glossary



Bio-intensive agriculture A modern development of a traditional organic system that gives maximum output from a small area of land while maintaining the fertility of the soil. It involves double digging to aerate the soil, composting, and both intensive and companion planting to increase efficiency and productivity.

Invasive species Non-native species that establish in an area and grow vigorously at the expense of local plants or animals.

Water harvesting Collecting and storing rainwater.



An alternative approach to addressing water scarcity in the region is the creation of ice stupas (see Further reading).

Improved livestock farming

Traditionally farmers have kept a few animals, mostly chickens, goats and buffalo, to supplement their diet. The AFRC has trained and supported farmers to improve the quality of these livestock by maintaining animal health, managing proper animal sheds and introducing better breeding programmes.

Five male buffalo have been brought into the breeding programme, and efforts are underway to crossbreed the local goats with improved varieties which are better suited to the changing climatic conditions. Some 500 females have been crossed with the 11 jamnapari and bettal goat breeds introduced in Deusa. A piglet production centre has also been established at the AFRC and the 68

piglets sold by 2016 had raised an income close to £4,000. A further 34 piglets were sold in 2017.

Developing the local environment

Another aspect of the project has been forest management and slope stabilisation. Community Forest User Groups have been established and are provided with technical knowledge on forest conservation and monitoring. Plant nurseries at the AFRC produced 108,000 tree seedlings between 2014 and 2017, as shown in Figure 4. Planting these seedlings on slopes has helped to reduce erosion, as well as provide fodder and forage for the villagers. In other areas where the slopes are degraded or too steep to cultivate, broom grass (amriso) seedlings have been planted. These help to stabilise the slopes and provide the raw material for the traditional brooms used throughout Nepal.

Introducing cash crops

All these measures have improved the productivity of the farms, but a main focus has been developing cash crops. A cash economy can help the community become more resilient to the effects of climate change than they are as subsistence farmers. Farmers are being given training and support in producing macadamia nuts, coffee and hazelnuts, all of which grow well in the changing climatic conditions. These crops are not perishable and can withstand the long and difficult journey to Kathmandu (Box 2). The newly introduced hazelnuts will take some years to produce a crop, but coffee production is well underway and is starting to generate an income.

There are currently 300 farmers growing coffee in the main project area, with 8,000 mature trees, 5,000 of which are already fruiting. AFRC nurseries have provided 20,000

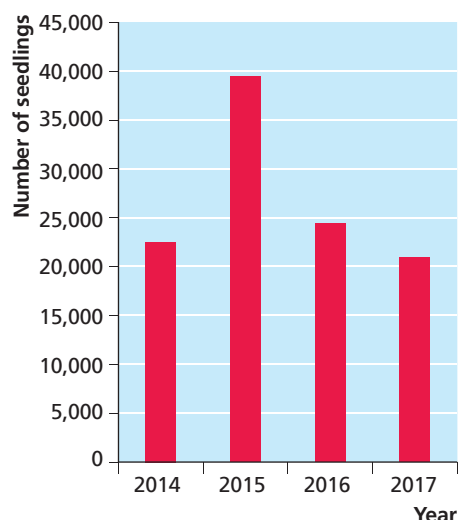


Figure 4 Tree seedlings distributed by AFRC, 2014–17

Box 2

Travelling in rural Nepal

Nepal has the lowest road density in south Asia, with 0.6 km of road per 1,000 people, compared to 3.0 km in India, 1.9 km in Bangladesh and 1.7 km in Pakistan.

In 2010, 37% of families lived more than 30 minutes from a paved road and 27% more than 3 hours. Deusa is approximately 4 hours from a paved road.

saplings, and a further 15,000 are being distributed in 2018. Output of the organically grown arabica beans is still quite low, with 2,000 kg harvested in 2017. At 500 rupees (about £4) per kg this provides a welcome income for the farmers. Production is set to treble in the next 2–3 years.

Coffee production is labour intensive as the 'cherries' are hand-picked and the initial stages of processing such as pulping and washing of the beans are also carried out by hand. The AFRC has funded six pulping machines which service eight collection sites, each serving between five and 30 farmers. The processed beans are carried on foot to the AFRC which, together with Eco Himal,

Further reading

A short piece from The Glacier Trust on the broom grass harvest, including a video of a landslide: www.tinyurl.com/ybf4eepw

Guardian article about a comparable project in Brazil: www.tinyurl.com/y8btyjon

Woodward, J. (2017) 'The big picture: Ice stupas and water security', *GEOGRAPHY REVIEW* Vol. 31, No. 2, p. 42.

Dilisher Rai with a coffee plant. The AFRC has helped farmers start growing cash crops like this



keeps accurate records of each farmer's production, checks the quality and manages the storage, transport and sale of the beans. The proceeds are returned to the farmers. The Glacier Trust is exploring partnerships with coffee traders in Nepal and the UK in order to maximise profits.

A regional centre of expertise

More than 1,000 farmers and their families in and around Deusa are feeling the benefits of the AFRC, and word is spreading. Farmers are now coming to the centre from a much wider area to learn new techniques and to buy seedlings from its nurseries. The next stage of the programme is to set up satellite centres at places such as Tingla, where one 'lead' farmer and his family have had training and support to develop a model kitchen garden. Here local farmers can receive training and buy seedlings, saving them the long trek to the AFRC.

Questions for discussion

- 1 The raw coffee produced by local farmers is sold for a relatively low price to a Kathmandu coffee trader. What steps could be taken to improve the returns?
- 2 What are the benefits of small bottom-up projects such as this, compared to top-down projects?

- 3 Why is the holistic nature of this project so important?
- 4 How can cash crops make farmers more resilient to climate change?

Mary Peart is a former geography teacher at the German Swiss International School, Hong Kong. **Dr Morgan Phillips** is co-director of The Glacier Trust, available for workshops and lectures in the UK via www.theglaciertrust.org

Key points



- Subsistence farmers in Nepal are feeling the effects of climate change.
- The AFRC is a project set up in a remote area to support farmers in improving and diversifying their agriculture.
- The project has introduced new crops and livestock, set up water harvesting and developed the growing of cash crops.
- As word spreads among farmers in the area, satellite training centres are being set up.
- This is an example of a small bottom-up development project.

Give yourself the edge in your A-levels

Get the grades you need with our A-level magazines

Our Review magazines give you the focused, topical information you need to make a difference to your studies and exams, with accessible articles, cutting-edge research and exam advice.

Sounds good? Check with your teachers or librarians whether your school has a subscription.

- **If so:** order an associated subscription via your school for as little as £12
- **If not:** you or your family can order an individual subscription – all issues delivered to your home at a 20% discount on the full price!

The 20% discount only applies to individual orders. To claim it, visit www.hoddereducation.co.uk and enter code WJ0008442 by 31 December 2018

