8

Environmental Change and Rural Areas

Introduction

If 'community' is one keyword associated with rurality (Chapter 7), then 'nature' is another. It may be argued that there are no truly 'natural' places left, that all rural areas have been shaped by human intervention to a greater or lesser extent, but the predominance of 'natural' features and materials in the rural landscape continues to be its most visually distinctive characteristic. The popular association of the countryside with 'nature' and the 'natural environment' explains in part why rural landscapes and places are valued in modern society, and why the 'rural idyll' has such appeal, yet it also emphasizes the vulnerability of the rural environment. We may value the countryside as a 'place of nature', but we often do not treat the natural environment of the countryside very well. Indeed, many of the key processes of social and economic change in rural areas over the past century have had significant, negative, environmental impacts.

This chapter examines environmental change in rural areas by focusing on three particularly prominent trends: the degradation of the environment by modern agriculture, including pollution, poisoning and the destruction of habitats; urban encroachment and the expansion of the built environment within rural areas, again producing pollution and the destruction of habitats; and the rural dimensions of global climate change, including the probable impact on the geography of agriculture and tourism. The level of concern that is attached to each of these trends, and therefore the responses that are considered to be appropriate, are influenced by the philosophy of nature that one adopts. From some perspectives, nature is regarded as resilient and able to adapt to change, from others, nature is seen as fragile and in need of protection. Thus, these different perspectives are discussed further in the first part of the chapter, which examines in more detail the association of rurality and nature.

Rurality and Nature

The identification of the countryside with nature is an offspring of the fundamental dualisms in western culture between nature and society and nature and civilization that have historically informed the separation of town and country in literature, art and

government policy. The alignment of rurality with nature has also produced moral geographies in which the countryside is held to be a purer, nobler and more treasured space than the city (see Bunce, 1994; Macnaghten and Urry, 1998; Short, 1991). Furthermore, these various elements have been drawn into the lay discourses by which individuals define their own 'rural identity' and understand places as rural (see Chapter 1). Bell, for example, highlights the importance placed on nature in the lay discourses of the residents of his anonymized case study village of 'Childerley':

> Although the villagers are by no means sure that the village of Childerley is a place of nature, they have no doubt that such places exist. Moreover, they do not doubt that there are country ways of living and people who follow those ways. A close association with nature, they find, is the surest way to identify what those ways and whose those people are. The moral foundation of country life … rests upon this rock. (Bell, 1994, p. 120)

This rather romanticized association of rurality and nature is built on three core components. First, the *rural landscape is perceived as a natural landscape*. It is distinguished from the urban landscape by the pre-eminence of ecological features, including flora, fauna and a relatively unmodified physical geomorphology. Although the concept of 'landscape' itself implies a fusion of the ecological and the human, the presence of human artifacts is only tolerated in this discourse of the rural landscape if they are essentially biological (for example, crops, forest, pasture, orchards), or employ local natural resources in small-scale constructions that conform to the prevailing aesthetic of the landscape (for example, dry stone walls, stone cottages, isolated farmbuildings) (Woods, 2003b).

Secondly, *rural activities are defined as those that use and work with nature*. Thus, farming, forestry, fishing, hunting and crafts such as basket-making are all held to be intrinsically 'rural' in a way that, for example, manufacturing industry, accountancy and skateboarding are not. Thirdly, there are perceived to be *rural people, who can be identified by their knowledge of and sensitivity towards nature*. True rural people, it is conjectured, are in tune with the changing of the seasons, understand the weather and have an innate knowledge of local plants and wildlife (Bell, 1994; Short, 1991).

Like many elements in the social construction of rurality (see Chapter 1), the above associations are idealized notions that are difficult to demonstrate empirically. Yet they are powerful ideas because they inform a popular conflation of the protection of nature with the protection of the countryside that has shaped the ways in which environmental change in rural areas is perceived and responded to.

On the one hand, a discourse of nature as pure, idyllic and vulnerable has been drawn on to position the rural environment as needing protection from damaging human intervention. Human activity in rural space is considered acceptable only insofar that it works with nature and constructs artefacts in the landscape that conform to the natural aesthetic (as described above). Developments that introduce large quantities of alien material (such as tarmac or metal) or modern technology into the landscape, or which appear disproportionate in scale to the morphology of the landscape, are considered to be unnatural and out of place (Woods, 2003b). Similarly, technological innovations in agriculture that employ synthetic chemicals, or that

involve the manipulation of nature (GM crops, for example), are positioned as harmful to the environment. From this 'natura-ruralist perspective', the disconnection of the human realm from the natural world that is a central characteristic of modernity (see Chapter 3) has eroded sustainable forms of rural living and produced environmental problems that are now perceived as threatening the character of the countryside.

On the other hand, a utilitarian perspective on the rural environment conceives of nature as being both wild and resilient. From this perspective, the rural in its 'natural' state is a wilderness that requires taming through road-building, bridge-building, electrification and so on in order to make it hospitable for human activity. At the same time, rural space is also represented as offering the opportunity for the harnessing of 'natural' resources for human service – through mining and quarrying, forestry and agriculture, the creation of reservoirs and the generation of hydro and wind power. Resilient nature is considered to be able to withstand the impact of such developments, and to adapt to scientific innovations in agriculture (Woods, 2003b).

The two perspectives offer contrasting approaches as to how environmental change in rural areas might be evaluated. They provide different guidance as to which changes should be represented as 'problems' and on the appropriate remedial action. However, both perspectives would recognize that the rural environment is changing and that these changes have resulted from a range of factors including the practices of agriculture, forestry and primary production; the impact of urbanization and building development; and the consequences of tourism and leisure activities; as well as environmental processes originating outside rural space (Box 8.1).

Box 8.1 Factors in environmental change in rural areas

Agricultural practices
- Use of pesticides
- Use of chemical fertilizers
- Increasing yields
- Removal of hedgerows
- Destruction of habitats
- Specialization – reduction of plant species

Urbanization and building development
- Loss of open space to housing etc.
- Construction of roads etc.
- Increased pollution
- Demand for drainage, water, sewerage
- Noise and light pollution

External processes
- Acid rain
- Removal of water for drinking etc.
- Global warming
- Downstream pollution

Forestry and primary production
- Deforestation
- Afforestation of open moorland
- Planting of non-native species
- Spoils of mining and quarrying
- Flooding of land for reservoirs

Tourism and leisure activities
- Demand for facilities, accommodation, car parks etc.
- Erosion of footpaths etc.
- Damage to trees, plants, walls etc.
- Litter
- Disturbance of wildlife

Agriculture and the Rural Environment

Modern capitalist agriculture turned the tables on nature. Traditional farming had been dependent on nature, restricted by soil type, climate and topography and at the mercy of the weather, pests and disease. For the pioneers of modern agriculture, however, these constraints and risks represented wasted capital and they began to harness new technologies to control, manipulate and modify environmental conditions. From long-established techniques such as irrigation and selective breeding, through 'improvements' to slopes and soils, to advanced biotechnology and the application of agrichemicals, agricultural practices were developed that changed the environment in order to enhance productivity (see also Chapter 4).

The first major warning that agricultural modernization of this type could lead to serious environment problems came in the 1930s when over-grazing, the conversion of grassland to arable land, and drought conspired in the American prairie to produce the catastrophe of the 'dust bowl' (Box 8.2). The experience of the dust bowl resulted in the replanting of grasslands in the prairie states and the introduction of government programmes for soil conservation, but fundamentally the agricultural practices that had contributed to the problem – changes in land use, the removal of vegetation, overstocking and the over-exploitation of water tables – not only continued but intensified under productivism.

Box 8.2 The dust bowl

The great plains of the central United States are natural grassland. However, in the early part of the twentieth century they were transformed by industrial agriculture. First came large-scale cattle ranching, with over-grazing thinning the vegetation cover. Then farmers moved into the more lucrative arable sector, ploughing up the grassland. Across the southern plains of Kansas, Colorado, Nebraska, Oklahoma and Texas, some 11 million acres (4.4 million ha) of grassland were ploughed for arable crops between 1914 and 1919. Between 1925 and 1930 another 5.3 million acres (2.1 million ha) were converted (Manning, 1997). The motive was economic. As Worster (1979) comments, 'by that time the Western wheat farmer was no longer interested in merely raising food for himself and his family. More than any other part of the nation's agriculture, he was a cog in an international wheel. As long as it kept turning, he would roll along with it. But if it suddenly stopped he would be crushed' (p. 89).

The change in land use removed vegetation and loosened soil. This could be tolerated in the unusually wet years of the late 1920s, encouraging expansion into the most environmentally marginal regions, particularly as farmers were pressurized by a severe economic depression. In 1931, however, the rains failed. Average yearly precipitation across the region from 1931 to 1936 was only 69 per cent of normal levels. In the drought conditions the soil dried to dust, and with little vegetation to hold it together, the soil was rapidly eroded by strong winds that whipped up fierce dust storms. The worst affected area was the region where the Oklahoma panhandle intersects with the states of Kansas, Colorado, New Mexico and Texas, but between 1935 and 1940 areas of severe wind erosion periodically extended to cover the entire western half of Kansas, large parts of south-east Colorado and the cotton-growing region of northern Texas (Worster, 1979).

(Continued)

Box 8.2 (Continued)

At the height of the storms, in spring 1935, the University of Wichita in Kansas measured a cloud of some five million tons of dust suspended over 30 square miles of the city (Manning, 1997). The worst single storm, on 14 April 1935 – Black Sunday – travelled from northern Kansas to Texas, blacking out daylight for more than four hours as it passed. The next day a report in the *Washington Evening Star* coined the term, 'the dust bowl of the continent' (Worster, 1979). Confronted by the combination of drought and dust storms, crops failed or were destroyed and cattle starved. Buildings and farm structures were damaged by drifts of dust and the incidence of respiratory diseases increased significantly. The effects of the dust bowl compounded the earlier agricultural depression to create acute levels of poverty, particularly in the Oklahom panhandle, northern Texas and south-west Kansas. Over 3 million people left the region during the 1930s – many migrating to California. Some counties in the worst affected zone lost between a third and a half of their population (Worster, 1979).

By 1940 the dust storms had become more infrequent. The return of 9 million acres of abandoned farmland to nature helped to stabilize environmental conditions and government-led soil conservation programmes worked to restore grassland and plant shelterbelts of trees. Despite these efforts, soil erosion has continued to be a serious problem in the region.

For more on the dust bowl, its causes and its consequences, see Richard Manning (1997) Grassland (Penguin); Donald Worster (1979) Dust Bowl: The Southern Plains in the 1930s (Oxford University Press).

The second major warning came in 1962 with the publication of a ground-breaking book, *Silent Spring*, by an American scientist, Rachel Carson. Carson argued that the increasing use of inorganic chemicals in agriculture – as pesticides, herbicides, insecticides and so on – risked making the Earth an unfit place to live. She demonstrated how toxic chemicals passed through the food chain, devastating wildlife populations, and explored the potential threats to human health. In particular she highlighted the extreme toxicity of the chemical DDT, introduced in 1943 and used in pesticides, which Carson proved was responsible for significant numbers of deaths of birds, fish and mammals that were not its intended targets. Above all, Carson attacked the culture of biotechnology and the belief that nature could be controlled:

> The 'control of nature' is a phrase conceived in arrogance, born of the Neanderthal Age of biology and philosophy, when it was supposed that nature exists for the convenience of man … It is our alarming misfortune that so primitive a science has armed itself with the most modern and terrible weapons, and that in turning them against the insects it has also turned them against the earth. (Carson, 1963, p. 243)

Silent Spring had a dramatic impact on agricultural policy. The use of DDT was banned and measures taken to control the worst excesses of pesticides. Yet, again, the agricultural practices that contributed to the problem remained fundamentally unchanged. Farmers continue to use pesticides and other chemicals and biotechnology companies continue to attempt to control nature.

The rural environment has been significantly changed by the practices of industrial and productivist agriculture, and still is being changed. These impacts can be grouped into

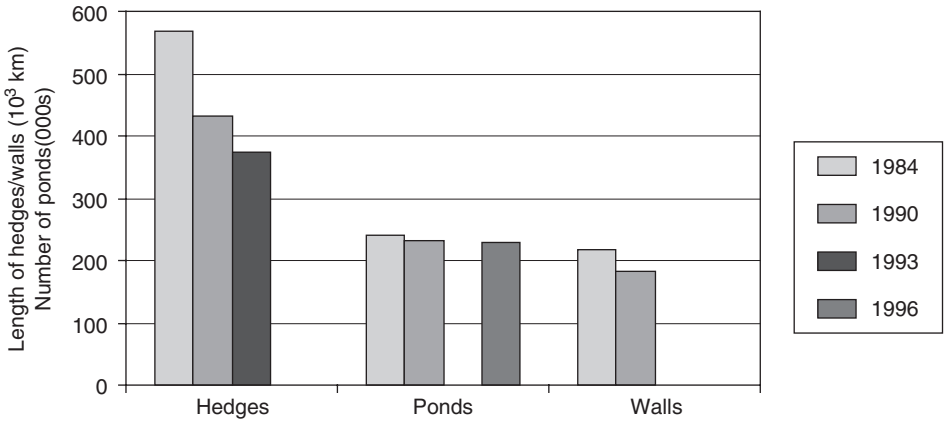

Figure 8.1 Extent of selected farmland features in Great Britain (pond and wall figures are for England, Wales and Scotland hedgerow figures and for England and wales only)
Source: After Cabinet Office, 2000

three dimensions – the destruction of habitats and loss of flora and fauna; the pollution of watercourses; and soil erosion, flooding and the lowering of aquifers.

Loss of habitats, flora and fauna

The extent to which the loss of wild plants and animals is considered to be an environmental problem created by agricultural practice is a matter of perspective. Some destruction of flora and fauna is deliberate on the part of farmers as they seek to eradicate pests and weeds and has always, in one form or another, been part of farming. The difference introduced by industrial agriculture is that the chemicals employed as pesticides and herbicides are more indiscriminate than biological or manual methods and can have unanticipated effects elsewhere in the food chain. Similarly, the destruction of habitats is for many farmers an acknowledged and accepted side-effect of efforts to improve productivity. Drawing on the idea of resilient nature, they will argue that nature can withstand the loss of the occasional hedgerow, pond or meadow. Environmentalists, however, contend that the aggregate loss of such habitats seriously depletes the populations of native species.

Modern agriculture primarily impacts on wild plant and animal populations through three processes of agricultural 'modernization', each aimed at increasing farm productivity or income. First, habitats are lost through the modification of farmland. The pursuit of higher productivity leads farmers to minimize the amount of unused land on farms, whilst the effective use of machinery such as combine harvesters favours large, uninterrupted, fields. Together these factors have provided a rationale for the removal of hedgerows that previously formed field boundaries. Between 1945 and 1985, 22 per cent of hedgerows in England and Wales were removed or otherwise lost, with some 8,000 kilometres of hedgerow lost each year during the 1970s (Green, 1996). A further third of remaining hedgerows disappeared between 1984 and 1993 (Figure 8.1). Around a third of native British plant species have been recorded in hedgerows, but as Green (1996) notes, only about 250 species occur regularly in hedges and none of these is threatened with extinction as a result of hedgerow

removal. More serious, Green suggests, is the impact of the loss of breeding grounds for animals leading to smaller populations. Three in four species of British lowland mammals breed in hedgerows, as do seven in ten native species of bird and four in ten species of butterfly (Green, 1996).

Secondly, habitats are also lost through changes in land use for economic reasons. The higher rate of return from arable farming than from pastoral farming has encouraged the conversion of large areas of pasture into cropland. In Europe, conversion to cropland was supported by grants under the Common Agricultural Policy, and even after subsidies were withdrawn market forces have continued to dictate the trend. Some 122,227 hectares of permanent grassland (or 4.1 per cent of the total) were lost in England and Wales between 1992 and 1997 – the equivalent to the area of a hundred soccer pitches disappearing every day (Wilson, 1999). Consumer fashions can also have an influence. The area of orchards in England and Wales fell from 62,000 hectares in 1970 to 26,000 hectares in 2002 as supermarket purchases have switched from native apples and pears to cheaper imported fruit (DEFRA, 2003).

Thirdly, plants and animals have been affected by the use of chemical pesticides and herbicides. As Carson noted, the introduction of new chemicals, including DDT and other chlorinated hydrocarbons, into agricultural use passed lethal toxins into the food chain. The impact on birds and predator mammals is summarized by Green:

> In Britain there were mass deaths of seed eating and other farmland birds including pigeons, pheasants and rooks, and of their predators particularly raptors and foxes, especially in the corn growing areas of East Anglia. The population of golden eagles collapsed and the peregrine falcon became a rare species all over the country: by 1963 its UK population was only 44% of the 700 pairs breeding in 1939. In other parts of the world the decline was even greater: in the USA its population fell by 85%. Research by the Nature Conservancy in [the UK] was instrumental in substantiating that the cause was the new pesticides. Dieldrin (used as a seed dressing to give protection against the wheat bulb fly) and Aldrin (used in sheep dips) were being passed along the food chain to predators. (Green, 1996, p. 208)

In addition to poisoning, DDT and similar pesticides harmed bird populations by thinning the eggshells of some species, reducing rates of successful reproduction. Shell thinning in the eggs of the South Carolina brown pelican, for example, contributed to a decrease in the breeding population from more than 5,000 pairs in 1960 to 1,250 pairs in 1969 (Hall, 1987). Other species have suffered from the effect of pesticides and herbicides in reducing their food supply (Green, 1996).

The above processes have also worked collectively to damage habitats. For example, the disappearance of 97 per cent of wildflower meadows in the UK since the 1960s is a result not just of conversion to arable land but also of the application of herbicides to remaining grassland and poor land management. Similarly, hedgerows that have been left *in situ* have been depleted by chemicals, either directly applied or drifting from adjacent fields, such that

> where hedges do survive on farmland, their wildlife now is usually very limited. A few coarse herbicide-resistant weeds such as cleavers and others such as cow parsley, hogweed, false oat and sterile brome, which are favoured by fertiliser at the expense of less competitive species, are often all that remain of once-rich floras. (Green, 1996, p. 206)

Table 8.1 Change in population of selected British farmland birds

	%Change	
	1968–99	**1994–9**
Grey partridge	–85	–33
Corn bunting (farmland habitats)	–88	–38
Lapwing (farmland habitats)	–40	–2
Skylark (farmland habitats)	–52	–10
Linnet (farmland habitats)	–47	+2
Kestrel	–4	+2

Source: British Trust for Ornithology (Common Birds Census), www.bto.org/birdtrends

Furthermore, the impact on wildlife is often intensified by the combination of these processes. The populations of many bird species, for instance, have been hit not just by direct chemical poisoning, but also as a result of the loss of nesting sites in hedgerows and the depletion of food supplies by the use of insecticides and herbicides. As Table 8.1 shows, the numbers of many farmland birds have decreased dramatically (see also Harvey, 1998). Overall, the population of 12 common farmland bird species in England fell by 58 per cent between 1978 and 1998.

There is some evidence that more recent changes in agricultural policy and practice, including the introduction of agri-environmental schemes (see Chapter 13) and the growth of organic farming (Chapter 4), have begun to reverse the decline in wildlife populations. Studies in the UK have indicated that 30 species of bird, spider, earthworm and wildflower out of 92 monitored were present in greater numbers on organic farms than on conventional farms, and that populations of butterflies are increasing on farms with agri-environmental projects. However, such recoveries remain comparatively small compared with the scale of population loss over the past 50 years.

Pollution of watercourses

The intensive use of chemicals in agriculture has also increased the pollution of watercourses draining farmland. Some of this again results from pesticides, which enter watercourses either by surface run-off or by leaching through the soil. Once in rivers and lakes, pesticides can act to reduce reproduction levels in fish and other aquatic organisms, as well as lowering water quality to below fit standards for human consumption. In 1993 concentrations of the herbicide atrazine were found to exceed EU drinking water standards in 11 per cent of samples taken from rivers in England and Wales (Harvey, 1998).

The most serious form of agriculture-related pollution, however, is by nitrates and phosphates from inorganic fertilizers. The annual use of nitrogen-based inorganic fertilizers in the UK increased from 200,000 tonnes in 1950 to 1,600,000 tonnes in 1985 (Winter, 1996) and there are similar levels of usage elsewhere in the European Union. The application of nitrogenous fertilizers to crops significantly increases productivity, but it also increases the productivity of the most competitive weeds, such as nettles, which consequently monopolize hedgerows and verges, dominating less competitive species. When washed into watercourses on eroded soil particles, nitrates produce a similar result:

> The accidental eutrophication of these waters has exactly the same ecological effect as does its deliberate use on grassland to increase crop yield. The more vigorous waterweeds are favoured and they rapidly reduce the diversity of the ecosystem by outcompeting other plants which are lost, with their associated animals. In water this effect is magnified by the kills of fish and other aquatic animals that result from deoxygenation brought about by the aerobic microbial breakdown of greatly increased plant

> production. Thousands of coarse fish, sea trout and swan mussels died from these causes on the River Rother in Sussex in 1973 and piled up in a stinking mass following a draining scheme in the valley. (Green, 1996, pp. 211–212)

Some 300,000 tonnes of nitrates are leached into British rivers each year, with particularly high concentrations in watercourses draining intensively farmed arable areas (Harvey, 1998). In the United States, over 10 kg per hectare of nitrates may find their way from the croplands of Iowa, Illinois, Indiana and Ohio into the Mississippi river system, with the cumulative build-up of nitrogen eventually resulting in a 15,000 km^2 'hypoxic zone' in the Gulf of Mexico in which there is insufficient oxygen in the water during summer to support normal populations of fish and shellfish (USDA, 1997). Whilst nitrate pollution is associated with arable farming, similar effects can result from the pollution of water courses with livestock slurry and silage effluent. Cattle slurry is 80 times more polluting than raw domestic sewage and silage effluent up to 170 times more polluting (Lowe et al., 1997).

Agricultural pollution can pose a threat to human health when drinking water supplies are contaminated. There is a strong correlation between poor quality water and areas of intensive farming. Parts of England with drinking water supplies below the acceptable European Union standard in the late 1980s included the major arable farming areas of East Anglia, the Vale of York and Salisbury Plain (Ward and Seymour, 1992); whilst the water at only two out of 50 sampling sites on rivers in Brittany, France, was deemed to be of passable quality in 1999 (Diry, 2000).

Soil erosion and aquifer depletion

In spite of the experience of the dust bowl and the soil conservation programmes launched by the US government in response, soil erosion remains a major problem in rural areas. A degree of soil erosion is natural, but modern farming practices can intensify the process beyond tolerable levels. In particular, soil erosion is aggravated by the removal of vegetation – including the conversion of pasture to arable fields, the destruction of hedgerows and deforestation – the creation of larger fields, the abandonment of rotation farming for specialization, and the use of large machines that need to be worked up and down slopes rather than along contours (Green, 1996; Harvey, 1998; USDA, 1997). Around 2.8 billion tonnes of soil were eroded from cropland in the United States in 1982, and whilst conservation programmes succeeded in reducing this total to 1.9 tonnes in 1992, erosion rates were still more than twice the tolerable level in around 9 per cent of arable land, including large parts of Texas, eastern Colorado, Montana and the central plains of North Carolina (USDA, 1997).

Agricultural practices that provoke soil erosion are counterproductive in that one of the major results is reduced soil productivity. Soil erosion also contributes to the destruction of habitats, as native plants can no longer survive on denuded top soils, to the pollution of watercourses by pesticides and nitrates, and to localized flooding. In southern Europe, soil erosion associated with the conversion of traditional forms of cultivation to intensive arable production has contributed to creeping desertification, particularly in southern Italy, south-central Spain and upland Greece. Attempts to maintain productivity levels in such conditions are supported by irrigation, which can in turn produce environmental problems of aquifer depletion if the rate of extraction exceeds the rate of replenishment by precipitation. Severe groundwater depletion has been recorded in a number of parts of the United States, including the massive Ogallala or High Plains aquifer that provides

water for some 8 million hectares (or 5 per cent of the total farmed area in the United States) from Texas north to South Dakota and Wyoming, and where over-extraction has resulted in water table declines of over 30 metres (100 feet) in the worst affected areas (USDA, 1997).

Urbanization and the Physical Development of the Countryside

Rural environmental change also occurs through the physical development of the countryside. The construction of buildings, roads, car parks, airports and power stations, along with other permanent structures, is perceived to introduce an unnatural, urban, presence into rural space. In addition to this discursive impact, such developments have a measurable environmental impact through the removal of vegetation, disruption of hydrological systems and destruction of habitats. The physical development of the countryside can, depending on the circumstances, be either driven by the consequences of rural social and economic change, or imposed by external actors. Generally, however, developments are linked to one of four processes.

First, there is continuing urban encroachment on rural space. The area of 'urbanized space' in the United States more than doubled from 10.3 million hectares in 1960 to 22.6 million hectares in 1990, and was predicted to exceed 25 million hectares by 2000 (Heimlich and Anderson, 2001). This rate of expansion is far greater than that of urban population growth and reflects social trends towards smaller households and residential preferences for low density housing being met through contiguous suburban development. One major effect is to squeeze the capacity for agriculture in the urban–rural fringe (which currently accounts for around a third of total US agricultural production). Between 1982 and 1992 nearly 1.7 million hectares of cropland in the United States were converted to developed land, 68 per cent of it for residential use, and low density urban sprawl is estimated to reduce the value of agricultural production in the Central Valley of California by $2 billion each year (USDA, 1997). Other environmental impacts include the destruction of habitats, the loss of aesthetically valued recreational land, and local problems of waste disposal, water supply and disruption of drainage systems, the latter of which can lead to flooding and landslides (Rome, 2001).

National and local governments have adopted a number of initiatives to restrict urban sprawl, including planning controls (see Chapter 13), and the purchase of 'greenbelt' land for protection under public ownership (Rome, 2001). The consequence, however, can be for development simply to 'leapfrog' over protected areas into the surrounding rural areas. Thus, secondly, population growth in rural areas has generated demands for development within the countryside itself. Around 80 per cent of new housing development in the United States between 1994 and 1997 was located outside urban areas (Heimlich and Anderson, 2001). Similarly, in rural parts of the UK, such as Dorset, significant new housing development has taken place in rural communities, particularly in small towns (Table 8.2 and Figure 8.2). This trend is anticipated to continue. Land use planning policy in the UK has projected that 2.2 million new houses will need to be built in rural areas by 2016, in turn provoking a fierce political debate (see Chapter 14).

Thirdly, the changing social and economic character of the countryside has created demands for the development of new infrastructure, including new roads, car parks, sewerage systems and shopping facilities. Pressure for such developments is produced not just by population growth and new house growth, but also by the rise in commuting, the relocation

Table 8.2 New houses built in Dorset, England, 1994–2002, by population size of parish

Population of parish in 1994	No. of parishes	No. of new houses built 1994–2002	% of all new houses built in county	% of total population of county	Mean no. of new houses per parish
Under 250	121	202	1.3	3.5	1.7
250–499	52	484	3.2	5.0	9.3
500–999	38	959	6.4	7.9	25.2
1000–2499	27	1555	10.3	9.3	57.6
2500–4999	10	1392	9.3	10.0	139.2
5000–9999	13	4267	28.4	26.7	328.2
10000–19999	4	3063	20.4	15.2	765.8
Over 20000	2	3122	20.8	22.3	1561.0

Source: Dorset County Council

Figure 8.2 New housing in the village of Burton Bradstock, Dorset, built in the local vernacular using reconstituted stone
Source: Woods, private collection

of industrial plants and offices, and the expansion of tourism (Robinson, 1992). Major infrastructure such as highways and railways are also routed through rural space to connect urban centres. The visual disruption to the rural landscape and the physical destruction of habitats have emerged as keys sites around which environmental protests against new roads have been mobilized in locations as diverse as Newbury and Twyford Down in England, Wyoming County in New York State, the Interstate 69 route in Indiana and

Thüringen in Germany. More subtle environmental effects of development are the increases in light pollution and noise pollution in rural areas. For example, a British pressure group, the Campaign to Protect Rural England (CPRE), has claimed that the extent of 'tranquil areas' in England – defined by distance from major sources of noise pollution such as significant roads, airports and power stations – decreased by 21 per cent between the 1960s and 1990s (Figure 8.3).

Fourthly, rural locations have continued to be favoured as sites for large-scale, noxious and otherwise sensitive land uses, whose development is either easier, or faces less resistance, in less populated regions. These include airports, reservoirs, power stations, prisons and military camps. As well as the environmental impact of the development itself, in some cases the nature of the land use concerned may also introduce new environmental risks. For example, rural Tooele County in Utah contains a magnesium factory, a private low-level nuclear waste burial site, three toxic chemical stores and a military depot that stores half of the United States's chemical weapons. In 1999, a conflict developed between the State government and local tribal authorities over the construction of a facility in the Skull Valley Goshute Reservation for the interim storage of high-level nuclear waste, intended for eventual disposal at a proposed (and equally controversial) dump at Yucca Mountain, Nevada. Whilst tribal leaders argued that the facility was needed to create jobs on the reservation, the State expressed wider public concerns about pollution by radioactive material (Wald, 1999).

Climate Change

Rural environmental change is not just the result of human activities within rural space but is also influenced by global scale environmental processes, such as global climate change. There is now a significant scientific consensus that human activity has increased atmospheric concentrations of 'greenhouse gases' – carbon dioxide, methane, nitrous oxide, chloroflurorocarbons and ozone – and that as a result the global climate is changing and is likely to change dramatically over the course of the next century. The key impacts identified by the Intergovernmental Panel on Climate Change (IPCC) include an increase in the overall global mean temperature of between 1.4 to 5.8 degrees celsius by 2100, higher maximum temperatures and increasing minimum temperatures over most land areas, more intense precipitation events and an increase in the sea level globally of 10–50 cm by 2050 (IPCC, 2001).

Rural areas contribute to climate change through the production of 'greenhouse gases' (particularly methane), and can also help to moderate climate change through carbon sequestration by agricultural crops and forests (Bruinsma, 2003; Rosenzweig and Hillel, 1998). Moreover, the economies and societies of rural areas are vulnerable to the environmental consequences of climate change. Although the modeling of climate change impacts is an imprecise science and different models vary in their predictions, a number of likely consequences can be identified with respect to agriculture, tourism and human communities.

Agriculture

Increased concentrations of carbon dioxide in the atmosphere should in theory increase photosynthesis and stimulate greater productivity for agricultural crops, yet the IPCC and other commentators have argued that this benefit is likely to be offset by negative impacts including crop damage from higher temperatures and extreme events, drought, soil degradation and changing ranges of pests and diseases (IPCC, 2001; Rosenzweig and

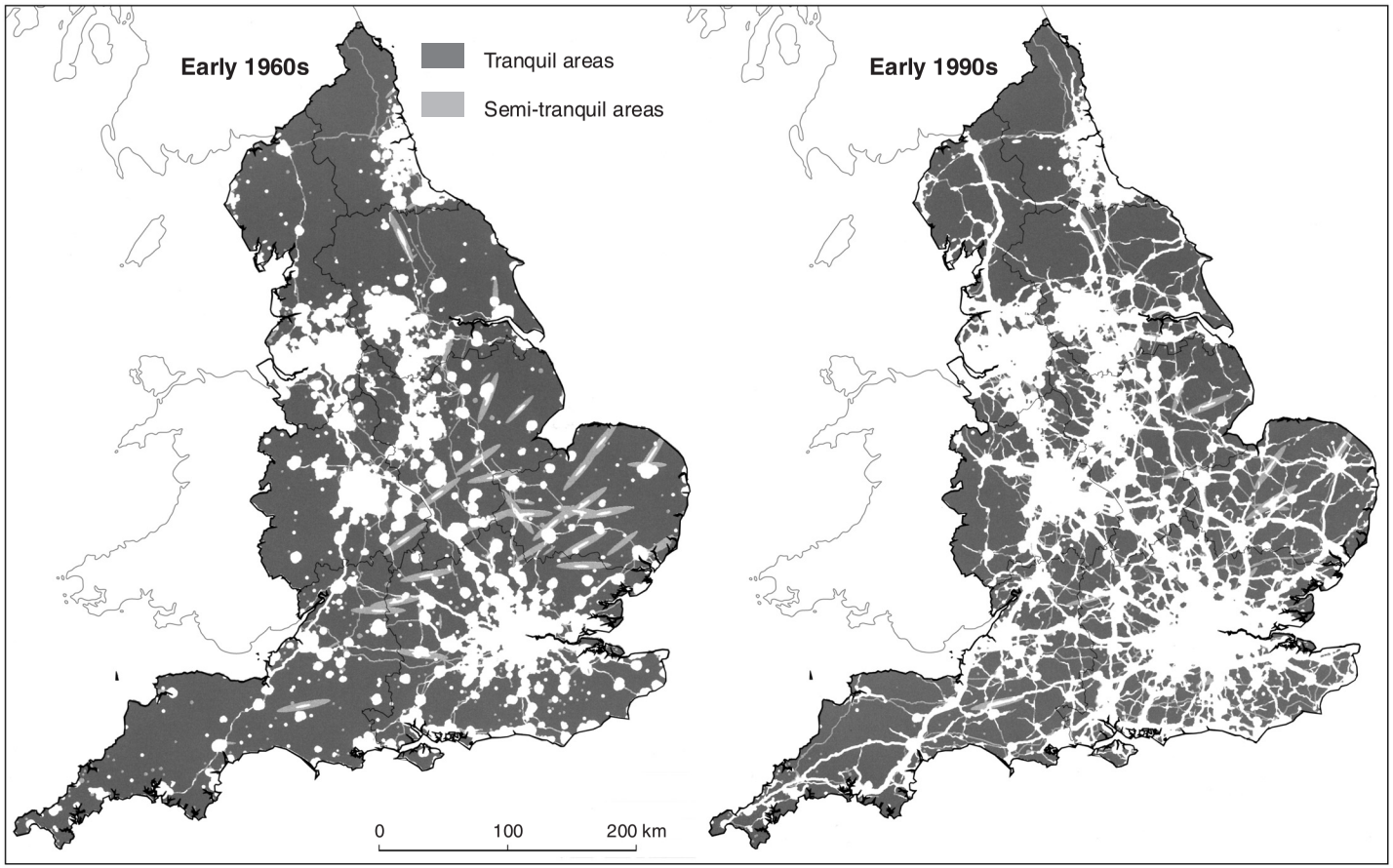

Figure 8.3 'Tranquil areas' in England (shaded) in the 1960s and 1990s, as defined by the Campaign to Protect Rural England (CPRE)
Source: CPRE

Hillel, 1998). The agricultural impact of climate change is therefore likely to be spatially differentiated. Crop productivity is most probable to increase in high-latitude regions such as Canada, Scandinavia and Russia, whilst productivity is predicted to decrease most substantially in tropical regions (Rosenzweig and Hillel, 1998). In effect this will mean that poorer developing countries will suffer most from climate change, whilst some developed nations may be in a position to benefit from new trade opportunities. However, even within developed states there are likely to be significant changes in the geographies of agricultural production.

In New South Wales, Australia, increased temperatures, reduced soil moisture, more frequent heavy rainfall and decreased river flow are all projected to have a negative impact on agricultural production. The area of arable land is expected to be reduced as a result of drought and soil degradation and increased carbon dioxide concentrations are predicted to reduce grain quality. Similarly, increased incidences of heat stress in cattle are projected to reduce dairy production in New South Wales by around 4 per cent by 2030 (Harrison, 2001). In Europe, the cultivation of olives and citrus fruit is projected to move northwards as Mediterranean zones become more prone to drought (Rosenzweig and Hillel, 1998). New crops such as navy beans could be introduced in the UK, offering farmers an opportunity for diversification (Holloway and Ilbery, 1997). The most economically significant impact, however, is likely to be in North America where more frequent droughts and heat waves could substantially reduce crop production in the prairie regions, especially the southern plains (Rosenzweig and Hillel, 1998). The extended drought of 1988 is regarded by some commentators as a foretaste of future problems and saw crop yields in the US grain belt drop by 40 per cent. Other regions, however, including parts of Canada, the Great Lakes area and the Pacific states, could see increases in arable production as they become regarded as more favourable environments.

Tourism

Climate change poses challenges for both winter and summer tourism in rural regions. Temperature increases are already reducing snow cover in mountainous areas, threatening the winter sports industries in New Zealand, the Alps and the Rocky Mountains. Summer tourism, meanwhile, is likely to be affected by problems of water supply and heat stress in areas such as southern Europe, and by sea level rise and exposure to typhoons in rural coastal zones of Australia. Rural economies that have diversified from agriculture into tourism may therefore find that further economic restructuring becomes necessary. At the same time, however, patterns of more consistently dry and warm summers could help to boost countryside tourism in more temperate parts of northern Europe and North America, thus providing new opportunities for economic diversification (IPCC, 2001).

Human communities

Aside from the economic challenges to agriculture and tourism, climate change also can have a direct impact on the everyday lives of people in rural areas. The low population densities of some rural regions reflect the already harsh environmental conditions and many are particularly exposed to extreme weather events such as storms, tornados, flooding and drought, all of which are predicted to increase with global warming. Additionally, the culture of some indigenous communities in remote rural regions is threatened by the impact of climate change on wildlife. Both of these processes are starkly evident in Alaska, where temperatures are increasing at ten times the global average.

Since 1960, average winter temperatures in Alaska have risen by 4.5 degrees celsius, with the consequence that snowfall has decreased, glaciers are retreating and the tundra is melting. The thawing of the permafrost has caused problems of subsidence and landslips damaging buildings and roads at a cost of over $30 million per year. The environmental changes have also dried up streams and rivers – starved of seasonal meltwater – and disrupted the feeding patterns of wildlife such as caribou and polar bears, reducing their numbers. These changes in turn threaten the traditional hunting- and fishing-based culture of the Gwich' in people living above the Arctic Circle (Campbell, 2001).

Significantly, however, many of the strategies promoted by campaigners in order to alleviate the human contribution to climate change are also challenging to aspects of rural life. For example, punitive taxes on petrol and diesel aimed at reducing consumption of fossil fuels have a disproportionate impact in rural areas where many residents are dependent on the use of private vehicles to access employment, schools and key services – as demonstrated by farmer-led protests against high fuel taxes in Europe in September 2000. Furthermore, any substantial transition to renewable energy sources depends on the construction of a large number of renewable power generation plants, notably hydroelectric stations and 'windfarms', in rural locations that can meet their resource demands. Such developments inevitably have an impact on the immediate local environment as well as conflicting with aesthetic appreciations of the rural landscape (see Box 8.3).

Box 8.3 The environmentalist's dilemma: wind power generation in rural locations

The harnessing of wind power is a crucial element in the transition to renewable energy. Commercial wind power generation was pioneered in Denmark in the early 1980s, closely followed by California, where from the installation of the first 'windfarm' in 1981 nearly 16,000 wind turbines were in operation by 1991 (Gipe, 1995). In the UK, wind energy is targeted to produce 10 per cent of the national electricity supply by 2010 (Woods, 2003).

Although in some places single wind turbines have been constructed to supply individual communities, most commercial wind power is generated by large-scale installations predominantly located in rural settings. However, such developments have increasingly been contested by local protest movements in the UK, Germany and the United States. As Brittan (2001) notes, objections to wind turbines are frequently aesthetic, but in many cases they also highlight ecological damage to the immediate local environment.

One such case concerned proposals to construct a 39-turbine wind power station at Cefn Croes in the Cambrian Mountains of Wales in 2000. The proposed windfarm was at the time the largest to be built in the UK and was promoted by supporters, including Friends of the Earth, as a significant contribution to renewable energy generation and to the alleviation of global warming. However, a vociferous protest campaign, supported by the local Green party and the Campaign for the Protection of Rural Wales, emphasized not only the visual impact on the landscape, but also the effect on local wildlife (Woods, 2003).

For more information see Michael Woods (2003) Conflicting environmental visions of the rural: windfarm development in Mid Wales. Sociologia Ruralis, 43 (3), 271–288.

Summary

Nature is at the heart of popular understandings of rurality, yet the natural environment of rural areas has been degraded by the human exploitation of rural space. Modern agriculture has become distanced from nature to the extent that practices such as removing hedges and the use of chemical pesticides and inorganic fertilizers have been blamed for falling populations of plant and animal species. Tourists, attracted by 'natural' rural landscapes, have contributed to environmental problems of erosion, pollution and the loss of land to building developments. Similarly, counterurbanization – motivated in part by lay discourses of the rural as a 'natural' space – has created demands for housing developments, and new roads and facilities, and has contributed to light pollution and the loss of 'tranquil areas'.

At the same time, rural areas have also suffered the consequences of global environmental change, including global warming. These have the potential to significantly alter patterns of agricultural production and tourism as well as causing damage to property and infrastructure and threatening the cultural practices of indigenous peoples. As such, the processes of rural environmental change have a cyclical character. They are produced or intensified by human activities and in turn they have an impact on human activity. The question of how human societies should respond to rural environmental change, however, generates different answers depending on one's perception of nature. From a utilitarian perspective, a certain amount of environmental change is not concerning, as nature is perceived to be resilient enough to adapt. In contrast, from a natura-ruralist perspective, environmental change has already resulted in irreparable damage to nature and urgent action is required to halt or reduce further change. Finding appropriate courses of action, though, inevitably involves compromises. Measures to protect wildlife habitats, for example, may involve an unprecedented degree of regulation of farming, whilst initiatives aimed at alleviating climate change, such as constructing wind power stations, can have a significant impact on the immediate local environment. Thus, although numerous conservation programmes and measures have been introduced (see Chapter 13), the appropriate response to rural environmental change remains a key source of conflict in the countryside (see Chapter 14).

Further Reading

Bryn Green's *Countryside Conservation* (Spon, 1996) and Graham Harvey's *The Killing of the Countryside* (Vintage, 1998) discuss in detail many of the changes to the rural environment, particularly those related to agriculture, albeit from a strongly British perspective. Adam Rome, in *The Bulldozer in the Countryside* (Cambridge University Press, 2001), meanwhile provides a historical overview of urban expansion into the American countryside and the rise of the environmental movement in response. For an overview of the potential impact of global climate change on agriculture see Cynthia Rosenzweig and Darrell Hillel. *Climate Change and the Global Harvest* (Oxford University Press, 1998).

Websites

A number of reports on climate change are available on the Internet, including those by the National Assessment Synthesis Team in the United States (www.gcrio.org/NationalAssessment) and the Department for Environment, Food and Rural Affairs in the United Kingdom (www.defra.gov.uk/environ/climate/climatechange).

Reports and (subjective) accounts of other impacts on rural environments are available on the websites of a number of pressure groups, including the Campaign to Protect Rural England (www.cpre.org.uk) and Scenic America (www.scenic.org).