knowledge were greater than that of their predecessors and called this 'progress'. Higher levels of material consumption and a greater ability to alter the natural world were regarded as major achievements. Progress was by definition beneficial and something all human societies should aim for in the future, and progress became associated, above all, with economic growth.

It would be naive to assume that this intellectual background provided the motivating force behind the rise of Europe and it is difficult to disentangle which was cause and which was effect. But the way Europeans thought about the world around them was important. It did help to provide an intellectual self-justification for what the Europeans did to the natural world, the way they reshaped other societies to their own ends and how they exploited the world's natural resources.

The Rape of the World

Over the last 10,000 years human activities have brought about major changes in the ecosystems of the world. The universal expansion of settlement and the creation of fields and pastures for agriculture, the continual clearing of forests and other wild areas, and the draining of marshy areas, have steadily reduced the habitats of almost every kind of animal and plant. The deliberate hunting of animals for food, furs and other products (and in some cases for 'sport') and the collection of plants has drastically reduced numbers of many species. Humans have introduced new plants and animals into ecosystems often with unexpected and near catastrophic results. The scale of wildlife losses in earlier periods is difficult to assess. There is more evidence, though still very patchy, for the period after 1600 but it is not until the present century that detailed research has been undertaken, largely prompted by a growing awareness of the increasing scale of the losses. There is no doubt though that the pace of destruction has been increasing, particularly following the expansion of Europe after 1500.

A reduction in wildlife habitats and extinction of species on a local scale can be identified from the time of the first human settlements. In the Nile valley the extension of the cultivated area, the draining of marshland and the organised hunting of animals led to the elimination of many species originally native to the area. By the time of the Old Kingdom (2550–2350 BC) animals such as elephants, rhinoceroses and giraffes had disappeared from the valley. The spread of settlement around the Mediterranean produced the same results with the destruction concentrated on the vulnerable animals at the top of the food chain. By about 200 BC the lion and leopard were extinct in Greece and the coastal areas of Asia Minor, and wolves and jackals were confined to the remote mountainous areas. The trapping of beavers in northern Greece had also driven them to extinction. The Roman addiction to the deliberate killing of wild animals in games and other spectacles added to
the slaughter. The scale of the continuing destruction to amuse the crowds across the Roman empire, year after year, for centuries, can be guessed at from the fact that 9,000 captured animals were killed during the 100 day celebration of the dedication of the Colosseum in Rome and 11,000 were slain to mark Trajan’s conquest of the new province of Dacia. By the early centuries AD, the elephant, rhinoceros and zebra were extinct in north Africa, the hippopotamus in the lower Nile and the tiger in north Persia and Mesopotamia.

The great spectacles of the Roman empire ceased in western Europe after the fifth century but the destruction of wildlife continued in other ways. Early medieval Europe consisted mainly of large areas of virtually undisturbed natural ecosystems with a small population living within it in scattered settlements (the exact opposite of the later landscape). The expansion of the settled area gradually reduced the habitats on which the plants and animals depended for their survival. Whole species became extinct and others disappeared across large areas or were severely reduced in numbers. The aurochs (the wild ancestor of modern cattle) was a woodland animal that suffered particularly from deforestation. It was extinct in Britain about 2000 BC and slowly disappeared from the rest of the continent. The last known specimen died in the Jaktorowa forest in Poland in 1627. The European bison was still found in the early medieval period across a wide area of Belgium and Germany but by the eighteenth century it was only found in eastern Europe and the last wild animal died in the Białowieża forest of Poland in 1920. The great auk, a flightless seabird, was once found in huge colonies along the Atlantic coasts of Scotland, the Western Isles, Orkney and Shetland and Iceland. It was a highly vulnerable prey – in one episode in 1540 two ships were filled with freshly killed auks in half an hour (producing five tons of salted birds) and the crew killed more birds to eat fresh. The eggs were also eaten by sailors and since the auk only laid one egg a year, its ability to breed was easily undermined. By the eighteenth century the bird was becoming rare around the British coast. The last pair were killed in Iceland in 1844.

Many more species which were once common in the whole of Europe have become extinct across large areas of the continent. Wolves were found in large numbers throughout western Europe until about 500 years ago. As late as 1420 and 1438 wolf packs were seen in the streets of Paris in daylight. In 1520 enough still survived for Francis I to organise official hunts and about a hundred years later in 1640 there are accounts of wolves coming down from the hills of the Jura to terrorise the inhabitants of Besançon. In Britain there were still enough wolves to warrant full scale hunts in Scotland during the sixteenth century. The last recorded sighting of a wolf came in 1486 in England, 1576 in Wales, in Scotland in 1743 and in Ireland during the early nineteenth century. The Brown Bear was also common across medieval western Europe (although it had died out in Britain by the tenth century). However, numbers declined steadily through hunting and destruction of its habitat and it now only survives in a few remote mountainous areas. The same pattern of events affected the beaver, which was also common in medieval Europe and was trapped for its fur. It died out in Britain as early as the thirteenth century and later across most of the rest of Europe.

Britain, as one of the first countries to become densely settled and industrialised, illustrates many of the forces that affected the whole of Europe. The crane became extinct in the sixteenth century. The sea eagle was still common as late as the 1870s but is now extinct. The conversion of grassland to arable farms, combined with extensive hunting, made the great bustard extinct by 1838. The osprey, which was so common in the eighteenth century that its occurrence was not a cause for any special comment, was, wrongly, believed to be a major predator on salmon. With the increase in salmon fishing in the nineteenth century it was ruthlessly hunted and driven to extinction. A few pairs returned in the twentieth century but it now only breeds under extensive protection. The game bird of the Scottish forests, the eapercaillie, was once common across the whole of the country, but relentless clearance of the forest reduced its numbers. By the seventeenth century it was restricted to the area north of the river Tay and the last example was seen in Inverness-shire in 1762. It was reintroduced in 1837 but the continuing clearance of the forest again reduced its numbers to a critical level – it is now estimated that only about 2,000 still survive. The golden eagle was still found in Derbyshire in the early seventeenth century and the Cheviots in the nineteenth but has now been driven to remote areas of the Scottish highlands. The chough was common in inland areas of Scotland till the early nineteenth century but is now rare even along the coasts. The red kite was once one of the commonest birds of prey. In the sixteenth century it was still found in the centre of London scavenging on rubbish in the streets. Over the next centuries it was hunted and its habitats destroyed. By the early twentieth century it had been reduced to about five birds and even now has recovered to less than a hundred pairs confined to central Wales.

While some of this trail of destruction was the side effect of agriculture and some the deliberate result of hunting and commercial exploita-
tion, it is also evident from contemporary texts that the idea of conservation and the preservation of wildlife was mainly noticeable by its absence until comparatively recent times. The general attitude towards the natural world was well summed up by the seventeenth century English clergyman, Edmund Hickeringill, who wrote that, 'So noisome and offensive are some animals to human kind, that it concerns all mankind to get quit of the annoyance, with as speedy a riddance and despatch as may be, by any lawful means.' In 1668 John Worlidge published his Systema Agriculturae which contained a calendar for the year with the following tasks affecting animals regarded as 'harmful' to agriculture:

February: pick up all the snails you can find, and destroy frogs and their spawn
April: gather up worms and snails
June: destroy ants;
July: kill . . . wasps and flies

Official policy followed the same trend. In 1533 the English Parliament passed an act (the Scottish parliament had passed a similar one in 1424) requiring all parishes to have nets to catch rooks, crows and crows. This was extended in 1566 so that churchwardens were authorised to pay for the corpses of foxes, polecats, weasels, stoats, otters, hedgehogs, rats, mice, moles, hawks, buzzards, ospreys, jays, ravens and kingfishers. In every area of England large hunts were carried out to try to exterminate various animals. In 1732 at Prestbury in Cheshire 5,480 moles were destroyed, at Northill in Bedfordshire between 1764 and 1774, 14,000 sparrows were killed (and 3,500 eggs destroyed) and at Deeping St James in Lincolnshire in 1779, 4,152 sparrows were killed. On one estate in the Scottish county of Sutherland in the early nineteenth century, 550 kingfishers were killed in just three years. In the same county on just two estates 295 adult and sixty young golden eagles (plus an unknown number of eggs) were destroyed between 1819-1826 (in an attempt to preserve fish and game for sport). The deliberate slaughter continued into the twentieth century – during the First World War the British government ordered the destruction of sparrows in order to try and increase crop yields and special clubs were set up to carry out the task. Their success can be judged from the fact that the one at Tring in Hertfordshire killed 39,000 in three years.

Hunting for 'sport' across Europe has been another destructive force although it is almost impossible to measure the scale of the killing, particularly of wild birds, carried out year after year, century after century. Some idea of its huge cumulative impact can be gleaned from a few isolated examples. At Wainfleet, in Essex, 31,200 ducks were killed in just one year in the mid-eighteenth century. At one village in Lincolnshire an average of 3,000 wildfowl were killed every year between 1833-1868. Trapping and shooting of migratory birds has continued in many parts of Europe until the present day. It is now estimated that one in six of the migrating birds in Europe is killed in this way, and in Italy about 200 million birds are still shot every year. Shooting birds for food has been continual and on a massive scale – 270,000 wild quail were on sale in 1808 in the markets of Paris alone. The range of birds eaten in the past was also much wider than today: it included curlews, plovers, blackbirds, larks, thrushes and even gannets (in the nineteenth century 1,300 a year were being killed on the Bass Rock alone). Eggs of wild birds were also a much sought after delicacy – by the 1870s the lapwing was almost extinct in the north of England because of the demand for its eggs. Other human demands could have an equally devastating effect. The great crested grebe was driven to the point of extinction in nineteenth-century Britain because of the market for its down to make ladies' muffins. In 1850 the large copper butterfly became extinct in England because people collected its caterpillars. The nineteenth century craze for birds in cages was also highly destructive. In 1860, 14,000 goldfinches a year were being captured just from the area around Worthing in Sussex and in the early twentieth century over 7,000 linnets a week were being sold in the London markets.

In every part of Europe both the variety and the extent of wildlife has been seriously reduced over the past centuries. The impact of European expansion on the rest of the world involved losses on an even bigger scale and in a shorter period. When the first Europeans reached the Americas, Australasia and the Pacific they were struck by the new and strange plants and animals they encountered. One European arriving in Australia in the 1830s noted some of the more striking differences:

'trees retained their leaves and shed their bark instead, the swans were black, the eagles white, the bees were stingless, some mammals had pockets, others laid eggs . . . even the blackberries were red.'

But above all the first explorers and settlers were stunned by the sheer profusion of wildlife in areas that had often seen little or no human settlement. Their accounts give some idea of the teeming mass of life
that untouched ecosystems could support. In 1658 when the French explorer Pierre Radisson reached Lake Superior, he reported that there were ‘stores of fishes, sturgeons of vast bigness, and pikes seven feet long. A month’s subsistence for a regiment could have been taken in a few hours.’ Thirty years later one of the first settlers in Florida reported that ‘quantities of wild pigeons, parrots and other birds were so numerous that boatloads of birds’ eggs were taken.’ In 1709 when an English sailor, Woods Rogers, landed on Mas Afua, one of the Juan Fernandez Islands off the coast of Chile, he wrote that the seals and sea lions were ‘so thick on the shore, that we are forced to drive them away, before we could land, being so numerous, that it is scarce credible to those, who have not seen them.’ At the end of the eighteenth century Captain Cook arrived in Australia and found that the sea was so full of fish that they broke the fishing nets and flocks of thousands of birds could easily be shot since they had no fear of humans. On the Great Barrier Reef the botanist of the expedition, Joseph Banks, wrote in his journal that the butterflies were so numerous that:

‘the air for the space of 3 or 4 acres was crowded with them to a wonderful degree; the eye could not be turned in any direction without seeing millions, and yet every branch and twig was almost covered with those that sat still.’

A few years later Captain Thomas Melville was sailing into Sydney harbour when he saw more sperm whales in a day than he had seen in six years in the old whaling grounds off the coast of Brazil. He wrote that ‘we sailed through different shoals of them from 12 o’clock in the day till sunset, all round the horizon, as far as I could see from the mast head.’

The profusion of wildlife appeared to these early explorers and settlers as a huge and readily available living food store. They proceeded to draw freely on this, without concern for the fate of any individual species, however strange or attractive or vulnerable it might be. This unrestrained killing fairly soon had a drastic effect in the case of islands where isolated populations had developed, often dominated by flightless birds because of the lack of predators (90 per cent of bird extinctions have occurred on islands). On Mauritius, for example, the introduction of the pig and rat, together with hunting by sailors looking for food, made the ground nesting dodo extinct by 1681. The example of Australia illustrates a number of major wildlife extinctions and substantial reductions in numbers since the start of European settlement. The introduction of rats killed seven of the twelve bird species on Lord Howe Island off the east coast of Australia. The duck billed platypus was common in the Blue mountains in 1815 but had disappeared by 1850. An expedition to the Murray-Darling basin in 1856–1857 recorded thirty one species of native animal – twenty two of them are now extinct. The widespread hunting of wild animals for ‘sport’, particularly organised mass kangaroo hunts, was one of the prime causes of the destruction. In 1850 one hunter, Captain Foster Fyans, lamented that in Victoria:

‘Emus and kangaroos on our arrival were plentiful in all parts ... also bustards in large flocks of ... 40 or perhaps more. The bustards now are scarce, and only met with in distant places. The kangaroo and emu are nearly extinct in the district; the country is almost void of game.’

By the end of the nineteenth century some of the rare marsupials such as the hare-wallaby and the banded hare-wallaby were already extinct and the last of the bilbies, which in the early nineteenth century had been the commonest form of native game, was shot in 1912.

The vogue for big-game hunting in the nineteenth and early twentieth centuries in Africa and India also had a major impact on animal numbers, especially carnivores such as lions and tigers at the top of the food chain. Some of the fashions of the period (many of which still continue), including crocodile skins for shoes and handbags, elephant tusks for their ivory and rhinoceros horn for its supposed aphrodisiac properties, added to the demand for large-scale slaughter of certain species. The demand for exotic feathers in hats in the nineteenth century meant that in 1869 Brazil alone exported 170,000 dead birds for their plumage and in 1913 the London salerooms were able to offer the feathers from 77,000 herons, 48,000 condors and 162,000 kingfishers. Plants were affected too. The collection and introduction of new species into Europe from all over the world (in the form of live specimens and not just seeds) was keenly pursued in the nineteenth century by plant hunters working for private collectors. These plant safaris probably did little damage except on a local scale but the rise of a mass market was a different matter. For example the craze for rare orchids in nineteenth century Europe meant that Brazil was exporting a minimum of 100,000 a year from the tropical forests.

The human impact on the wildlife of North America was even more devastating than in Australia. When the first Europeans reached the Great Plains of central North America they found huge bison herds
roaming the area. The minimum size of the herds was about 40 million animals and they may have reached a total of 60 million. When the Indians obtained horses and rifles from the Europeans they started hunting the bison for food and hides but they only killed about 300,000 a year, well below the natural replacement rate. The herds were therefore still around their original size when the Europeans began to exploit them in the 1830s. The bison were killed first for their meat — about 2 million a year — a rate which soon began to reduce the size of the herds. The slaughter was stepped up after 1871, when bison hides were first made into commercial leather, to about 3 million animals a year. This indiscriminate killing could not be maintained for very long. It lasted until the last decade of the nineteenth century when the herds were driven to the point of extinction. The bison now survives in a few carefully managed herds.

Probably the most terrible example of mass slaughter in the history of wildlife was not the bison but the passenger pigeon — a story that almost defies belief. The early Europeans in North America frequently commented on the huge numbers of blue, long-tailed, fast and graceful pigeons in the country. One of the first settlers in Virginia wrote that, 'There are wild pigeons in winter beyond number or imagination, myself have seen three or four hours together flocks in the air, so thick that even have they shadowed the sky from us.' Similar reports can be found from the Dutch on Manhattan Island in 1625, from Salem in Massachusetts in 1631 and some of the first explorers in Louisiana in 1698. As late as 1854 in Wayne County, New York, a local resident wrote that, 'There would be days and days when the air was alive with them, hardly a break occurring in the flocks for half a day at a time. Flocks stretched as far as a person could see, one tier above another.' On 8 April 1873 at Saginaw in Michigan there was a continuous stream of passenger pigeons overhead between 7.30 in the morning and 4 o'clock in the afternoon. Other reports describe flocks a mile wide flying overhead for four or five hours at a time during their migration in the early spring from the south to their breeding areas in New England, New York, Ohio and the southern Great Lakes area. The flocks were so thickly packed that a single shot could bring down thirty or forty birds and many were killed simply by hitting them with pieces of wood as they flew over hilltops. Their roosting sites were correspondingly enormous — some covered an area five miles by twelve with up to ninety nests in a single tree — branches broke and whole trees were toppled by the sheer weight of roosting birds, often standing on top of each other, and leaving a pile of droppings several inches deep under the trees. The exact number of passenger pigeons in North America when the Europeans arrived is not known but the best guess is 5 billion — about a third of all the birds in North America at the time and the same as the total number of birds to be found today in the United States.

One reason why the passenger pigeon existed in such prodigious numbers was the lack of natural predators apart from hawks and eagles. It was, however, surprisingly vulnerable to human intervention. Each female laid only one egg a year, which made it difficult to replace any losses quickly. Only a flimsy nest was made and its habit of nesting in vast colonies and migrating in huge flocks made it very easy to attack. The birds fed mainly on acorns, chestnuts and beechnuts in the extensive woodlands of North America and so when these were steadily cut down their habitat and food supplies were reduced. Human intervention was at first relatively restrained, largely because of the limited numbers living in North America. The Indians captured the pigeons in large nets and by the 1830s the settlers of New England were doing the same. The young squabs were regarded as a great delicacy and the adults were sought after for their feathers as well as their meat. In the first couple of centuries of European settlement it is doubtful whether the number of pigeons declined very much given the relatively small number of humans in the area. After 1830 the practice of releasing live pigeons from traps for shooting practice began, but this in itself would not have proved fatal to the existence of the species even though about 300,000 a year were being killed in this way in the 1870s.

The population had certainly been reduced by the middle of the nineteenth century but was still several billion strong. The real onslaught began with the onset of large-scale commercial hunting carried out by well-organised trappers and shippers in order to supply the developing cities on the east coast of the United States with a cheap source of meat. It began once railways linking the Great Lakes area with New York opened in the early 1850s. By 1855 300,000 pigeons a year were being sent to New York alone. The worst of the mass slaughter took place in the 1860s and 1870s. The scale of the operation can be judged by figures that seem almost incredible but which were carefully recorded as part of a perfectly legal and highly profitable commerce. On just one day in 1860 (23 July) 235,200 birds were sent east from Grand Rapids in Michigan. During 1874 Oceana County in Michigan sent over 1,000,000 birds to the markets in the east and two years later was sending 400,000 a week at the height of the season and a total of 1,600,000 in the year. In 1869, Van Buren County, also in Michigan, sent 7,500,000 birds to the east. Even in 1880, when numbers had
already been severely reduced, 527,000 birds were shipped east from Michigan. Not surprisingly, even the vast flocks of pigeons could not withstand slaughter on this scale. Numbers fell rapidly and by the late 1880s large flocks, which had once been so common, had become a matter for comment and investigation, and most were no more than a few hundred strong. The last known specimens were seen in most states of the eastern United States, in the 1890s, and the passenger pigeon died out in the wild in Ohio about 1900. The last survivor of a species that had once numbered 5 billion died in captivity in 1914.

Europeans also made their mark on the ecosystems of the rest of the world by introducing new species as well as exterminating many of those they encountered and severely reducing the numbers of many more. People who went to settle in these new areas took with them domesticated animals and also, accidentally, many of the pests they had known in Europe. Ever since the continents had drifted apart tens of millions of years earlier the flora and fauna of the Americas and Australasia had developed in isolation from their counterparts in Eurasia. Now, after 1500, they were brought into contact, often with far-reaching results. The peoples of the Americas and Australia had virtually no animals suitable for domestication and the Europeans therefore took their own animals (pigs, cattle, sheep and horses) with them. When these escaped and went wild they spread rapidly into a large variety of habitats.

Pigs were introduced everywhere. Once in the wild, they multiplied rapidly in the forests where they could find plenty of food. Australia now has over twenty million wild pigs. Cattle were first carried to the Americas by Columbus in 1493 and within fifty years were found in huge herds as far apart as Florida, Mexico and Peru. They flourished on the pampas of South America — by 1700 there were as many as fifty million of them. By the middle of the nineteenth century they were so numerous that walls for fields were made from cattle skulls placed nine deep. In Australia the wild herds can be traced back to eight animals that escaped from a domesticated herd in 1788. Domesticated sheep did not flourish in the Americas until they were taken to Mexico in the 1540s. Within thirty years there were immense, migrating wild herds, 200,000 strong in the Michoacan area alone, and by 1614 there were 620,000 sheep in the area around Santiago in Chile. In Australia and New Zealand there were no hoofed animals before the arrival of the Europeans at the end of the eighteenth century, yet within a hundred years there were a hundred million sheep and eight million cattle in Australia. In New Zealand there were nine million sheep within thirty years of its annexation by Britain and there are now some seventy million sheep and eight million cattle in the country. This massive increase in the number of grazing animals had major consequences for many of the native grasses of the area, especially kangaroo grass, which were not adapted to intensive grazing. They were replaced by European varieties. Horses were also taken to the Americas by Columbus in 1493 and they soon became wild. They migrated from Mexico to the Great Plains, where they were domesticated by the Indians, bringing a fundamental change in the way of life. From gatherers and agriculturalists some of the Indian tribes became hunters of the great bison herds. Europeans, moving westwards over the Appalachians in the eighteenth century, regarded the huge herds of wild horses as a pest and shot them in large numbers. Horses also went wild in Australia and again quickly became a nuisance. The camel was introduced into the central deserts of Australia in the late nineteenth century as a pack animal but the experiment was not a success and camels were allowed to go wild. Now regarded as pests, there are more camels in Australia than in Arabia. The honeybee was introduced into North America (which had no bees at all so the Indians used maple syrup as a sweetener), where it became naturalised by about 1800. Europeans also took honeybees to Australia in 1822, where they soon outnumbered the native stingless bee, and to New Zealand in the early 1840s.

The greatest ecological disaster caused by the deliberate introduction of a new animal came in Australia after Thomas Austin, a farmer near Geelong in Victoria, established a few rabbits for game in 1859. Well known as rapid breeders, in Australia, with no natural predators, they excelled themselves and were soon devastating crops over a wide area. By 1880 they had reached New South Wales and were also affecting sheep farming in parts of South Australia. Large scale eradication campaigns were mounted but to little effect — in the mid-1880s 1.8 million rabbits were killed in Victoria and nearly 7 million in New South Wales without perceptibly slowing up their relentless spread. By the 1890s the rabbit population was advancing across the Nullarbor desert towards Western Australia and new countermeasures were tried. A 1,000 mile-long fence was built from the north to the south coast in 1902–7 in an attempt to exclude the rabbits but it was breached in the 1920s.

The rabbit population of Australia increased, in less than a century, from a handful to about 500 million by 1950, and they were causing huge crop losses over much of the country. Almost continual eradication
campaigns had proved unsuccessful in stemming the rising flood of rabbits and in desperation in that year the disease myxomatosis was deliberately introduced from Brazil. Within a year an area the size of western Europe was affected and the death rate among the rabbit population was about 90.8 per cent. But bacteriological warfare against rabbits provided only a temporary respite: the tiny part of the population that was naturally immune to the disease was able to continue breeding and within seven years the death rate had fallen to less than 25 per cent. Despite subsequent periodic outbreaks of myxomatosis the rabbit population is once again growing rapidly. If Thomas Austin had known what had happened to the island of Porto Santo in the Madeiras in the fifteenth century, he might have thought again before introducing the rabbit into Australia. When the first Portuguese settlers arrived in the 1420s they found an island where the flora and fauna were completely unaffected by any previous human settlement. This soon changed when the rabbits they brought with them escaped and, benefitting from the absence of any natural predators, began to breed rapidly. Within a few years the land was devastated - large areas had lost all their plants and the bare soil was eroding away in prodigious quantities. The situation became so bad that the settlement had to be abandoned and all the people moved to Madeira. The island was only re-colonised with great difficulty thirty years later.

Accidental introduction of new animals, especially mice and rats which came unnoticed on many of the early ships, could be just as disruptive. Both the early settlements at Jamestown in Virginia in 1609 and at Sydney in Australia in 1790 were nearly wiped out because rats from the ships ate most of their precious stores of grain. During the 1750s, about fifty years after the Spanish conquest, Peru was already suffering from large scale plagues of rats. Much the same occurred in Australia after mice escaped from some of the early ships which visited the colony. There were no natural predators to restrain numbers and they multiplied rapidly. The scale of the problem can be judged from the fact that in just one area of South Australia thirty-two million mice were killed in only four months during 1917. Native animals could also be displaced by the introduction of European species. European starlings were first introduced to the United States in 1801 as ornamental birds in Central Park, New York. Some escaped and by 1926 flocks were reported from as far afield as Georgia, New England and Kentucky and after another thirty years the starling was established across the whole of the continental United States. Displaying its aggressive rather than any ornamental side it took over the ecological niches of a number of native birds and devastated the population of bluebirds and flickers.

The introduction of new animals could also affect plant life, often in dramatic and unexpected ways. Since goats were introduced to the island of St Helena in 1810, twenty-two of the thirty-three native plant species have become extinct because of their comprehensive grazing habits. In the 1830s when Charles Darwin visited the plains of Uruguay he found that hundreds of square miles of land were impenetrable because of the growth of the prickly cardoon, which had flourished thanks to the overgrazing of other edible plants by the huge herds of wild cattle and horses. The native plants of the Americas and Australasia have also been badly affected by the introduction of European species. European weeds such as ferns, thistles, plantain, nettles and sedge are now common in the United States, South America, Australia and New Zealand. In many cases they spread rapidly after initial introduction. Christmas Island in the Pacific was only settled in 1888 yet, by 1904, thirty species of European weed were flourishing on the island. In California there were only three non-native plant species in 1769 but within a century this had risen to ninety-one and European species constituted about half of the vegetation. By 1832, 137 European weeds were recorded in New York state and different ones had adapted to the different conditions in the southern states. On the pampas of South America in the eighteenth century the artichoke and giant Mediterranean thistle, which grew to about six feet high, went wild and created huge impenetrable areas. By 1877 there were 153 different types of European plant growing around Buenos Aires and fifty years later only a quarter of the plants on the pampas were of native origin. Even in Australia where, because of the harsh climatic conditions in the interior, the area open to colonisation by European plants was more limited, many native species were replaced. Within less than a hundred years of the first settlement there were 139 alien plant species in southeast Australia and the number is now over 800. In the more temperate climate of New Zealand, once the European bee had been introduced, new plants flourished so that over half of the plants now found in the country are of European origin. In some cases the introduction of new plants may have added to the variety of local flora but in many the consequences have been highly disruptive, often because the plant's natural enemies were left behind. A particularly telling example of this second category is the history of the prickly pear in Australia. Introduced in 1839 in order to provide hedges, it quickly went wild in Queensland and New South Wales creating barriers over six feet high.
By 1925 over sixty million acres of land were affected and in half of this area no other plants could grow. The prickly pear was eventually brought under control by importing south American catterpillars which feed on the plant.

The increased communications between different parts of the world also resulted in the spread of plant diseases and pests. These often proved to be more devastating in the new environment than in the old. For example, Asiatic chestnut blight, to which Asian species have developed considerable immunity, arrived in New York in 1900 and caused extensive destruction among native American species. It also arrived accidentally in Switzerland and Italy in 1938 and spread to many parts of Europe. The introduction of the potato to Colorado altered the habits of the Colorado beetle, which had until then fed on the wild sand-bur. The beetle rapidly became a major pest destroying potato crops across the United States as it spread to reach the east coast by 1874. Despite rigorous controls it reached France in 1920 and then spread to the rest of western Europe, reaching the Soviet Union in 1955. In the 1850s the American vine aphid (phyloxera), which normally lived on wild vines east of the Rocky mountains, was brought on board ships to Europe. It spread rapidly through the vineyards of Europe causing extensive destruction, even threatening the future of the wine industry. The outbreak was only brought under control by grafting European vines onto American rootstock which was resistant to the root phase of the aphid.

The effects of the expansion of Europe – its people, its plants and animals – were far-reaching and irreversible. The wildlife of the world was never the same again. Many species were driven to extinction or so reduced in numbers that they could barely survive in a few limited areas. Many animals and plants of European origin were spread around the world, disrupting natural ecosystems and again causing the extinction or decline of many native species. European domination of the world greatly increased the pressure on animals which could be killed for food or to provide furs, skins, oil and feathers to meet a wide range of utilitarian or luxury requirements, either for the settlers themselves or, more importantly, for the European market. In the face of some of the extreme examples it is difficult to answer questions such as why did the slaughter go on so indiscriminately and why wasn’t it seen as ultimately counterproductive? The extinction of the passenger pigeon (and other animals around the world such as the great auk and the dodo) and the near extinction of the American bison illustrate what the American ecologist William Ophuls has dubbed ‘the problem of the commons’.

No one ‘owned’ these animals and no one therefore had an interest in controlling the rate of killing and in ensuring a sustainable basis for continued exploitation. Because there was no ownership and because the cost of exploitation was very low (a horse and a rifle for the bison and a net for the passenger pigeon) many hunters were tempted into the market. In a highly competitive situation the most rational action for any individual hunter was to seek to maximise the immediate kill before a competitor did the same. The faster the overall population fell, the greater the temptation to kill as many as possible as quickly as possible. All the pressures, therefore, encouraged people to treat the animals as a short-term resource to be exploited as quickly as possible – indeed anybody who took the opposite view and tried to limit the numbers they killed would be far less successful economically and only increase the opportunities open to their competitors. This pattern of seeking to maximise the immediate short-term gain at the expense of any longer-term considerations is a central feature of the way in which modern societies have hunted and exploited animals. Little or no effort has been made to devise mechanisms that ensure that species are not over-exploited and driven to the point of extinction. The history of four major areas of exploitation – fishing, the fur trade, sealing and whaling – all illustrate the same dismal truth.

As only a small number of domesticated animals could be supported in medieval Europe, fish formed an important part of the diet. Later they provided not only variety but also, while stocks lasted, a cheap food. Until the sixteenth century fishing was largely confined to the coastal waters of Europe but even here the tell-tale signs of over-exploitation were already starting to appear. Stocks fell drastically and by 1500 fishing for herring in the Baltic had almost come to a halt. Within a few decades the same problem was affecting cod fishing off the coast of western Europe. By then, though, attention had turned to the Grand Banks off Newfoundland where the fish were so plentiful that they could be scooped out of the sea with buckets. Until the present century the stocks of fish in the vast oceans of the world seemed to be inexhaustible. It was not, however, until the development of mechanisation and factory fishing by fleets from the major fishing nations in the latter part of the nineteenth century, particularly in Britain and the rest of western Europe, that serious problems began to emerge. There was no attempt to limit catches and all the attention was devoted to increasing the effectiveness of exploitation. Fish numbers fell in area after area and as they did so the fleets turned to catching younger and
immature fish, which only exacerbated the problem. The fall in numbers in the area around western Europe can be traced for particular species and different fishing grounds. It first occurred in 1890 for plaice in the North Sea, in 1905 for haddock and in 1920 for cod in the same area. In the 1920s stocks of hake off Ireland and the south-west approaches, plaice off the Kola peninsula, cod and haddock east of Iceland, plaice to the west of Iceland and haddock off the North Cape had all fallen drastically because of overfishing. In California the sardine industry showed the symptoms of rapid expansion and equally rapid decline. It began about 1900 but really took off after 1915 with the development of an export trade in cheap canned fish. By the mid-1930s about 800,000 tons of sardines were being caught every year. Within ten years the industry collapsed because of overfishing.

Responding to improved technology and higher demand, the global fish catch rose rapidly after 1945, almost quadrupling from seventeen-and-a-half million tons a year to reach sixty-five million tons in 1970. But this was only achieved by intensive short term exploitation of a number of different fisheries and the rate of expansion has fallen off sharply—since 1970 the global catch has only increased by 18 per cent. Many more areas have been virtually exhausted since 1945. By 1955 the once prolific cod and perch fisheries near Newfoundland were suffering the same fate as the North Sea. In the north-west Atlantic the haddock catch fell from 250,000 tons in 1956 to less than 20,000 tons ten years later. The total catch of all species in this area reached a peak in 1968 and despite the fact that more boats fished the area the total catch fell by a half in only five years. The North Sea industry, the scene of the longest and most intensive exploitation, was badly affected. The industry itself had been unable to devise controls and governments belatedly introduced severe restrictions and quotas but too late to save the fishing industry, which has contracted drastically. The restrictions also came too late to save the fish. The total stock of fish in the North Sea is estimated to have fallen from about four million tons in the mid-1960s to less than one million tons twenty years later. The number of young haddock and cod around Britain in the late 1980s was at five per cent of the level only ten years earlier. The Japanese catch of chub mackerel in the north west Pacific fell from over one-and-a-half million tons in 1978 to less than half that figure four years later. As the more accessible areas have been overfished to the point of exhaustion, the world’s fleets have moved on to the last remaining unexploited areas such as the south Atlantic and Antarctic. Here the same symptoms, particularly the fall in the krill catch, are becoming apparent. The krill population grew rapidly because of the fall in the numbers of whales which fed on them. Extensive fishing did not start until after the early 1960s when just four tons a year were being caught. By 1982 this had risen to 520,000 tons a year but the symptoms of over-exploitation appeared and by the mid-1980s the catch had fallen to only 130,000 tons a year. The United Nations Food and Agriculture Organisation now estimates that eleven major oceanic fisheries have been overfished to the point of collapse.

A similar sequence of events (overfishing reducing once plentiful fish populations so drastically that it is no longer possible to exploit them economically) can be identified in some of the major lake and river fisheries which have also been affected by increasing levels of pollution. In the Caspian Sea the sturgeon catch is now only a quarter of the pre-1917 level and overall the fish catch has fallen by a half since the 1930s. The Great Lakes of North America tell the same story of an almost total disintegration of the fishing industry in the present century. In the eighteenth century sturgeon was so common in Lake Erie that they could be killed by hitting them with an axe handle. At the end of the nineteenth century the annual catch was over one million pounds weight a year. By 1964 it had fallen to less than 4,000 pounds. In the 1930s fourteen million pounds weight of cisco were caught every year but by the mid-1960s this had fallen to about 8,000 pounds a year. On Lake Michigan the annual catch of trout was about seven million pounds in 1943 but within a decade it had fallen to just 4,000 pounds a year. The development of salmon fishing as a ‘sport’ in the middle of the nineteenth century had a drastic affect on some rivers, particularly in Scotland. The salmon catch on the river Tweed at Berwick fell from 149,000 in 1842 to 40,000 a year by the late 1870s.

Trapping animals for their fur sustained one of the major trading activities in Europe until the nineteenth century. The fur trade in the earliest periods was a matter of exploiting European animals for the European market but when these supplies were virtually exhausted it became one of the driving forces behind the expansion of Europe, particularly the Russian drive eastwards into Siberia and the spread of European influence westwards across North America. The fur trade can be traced back to the Roman empire when merchants were obtaining furs from the nomadic tribes of Russia. But the real growth in the trade took place in early medieval Europe, when furs were sought after, not just for practical purposes such as keeping warm, but also as a status symbol, an indispensable part of the wardrobe of the upper classes. In England for example many regulations were made to try to restrict the
the twelfth century, as western Europe became wealthier, the Baltic was becoming an important trading area under the German Hansa merchants (about three quarters of the Hansa trade was in furs). Of the three main Russian centres, Novgorod concentrated on the more down market but flourishing squirrel trade, which became the economic foundation of the state. The value of land was reckoned in thousands of pelts and rents were paid in furs. Moscow and Kazan specialised in sable, fox and marten for the luxury market. They obtained supplies through a network of traders and the payment of tribute by nomadic tribes. The size of the Russian medieval fur trade and the extent of the corresponding slaughter of animals was huge, as a few surviving documents reveal. In 1393 one ship left Novgorod for Flanders carrying 225,000 furs and at this time London alone was importing about 300,000 squirrel pelts a year while Venice bought 266,000 skins from the Hanseatic merchants in 1409. The best estimate is that at the height of the squirrel trade Novgorod was exporting about 400–500,000 skins a year. There are no reliable figures for the Moscow and Kazan trade but its scale can be judged from the fact that in the early sixteenth century it was selling 40,000 sables a year just to the traders of the Ottoman empire.

Hundreds of millions of animals were killed at an unsustainable rate both in Russia and western Europe. As early as 1240 in the Don river basin around Kiev, the original centre of the trade, no fur-bearing animals were left and Novgorod merchants were already trading 1,000 miles away beyond the Urals in an attempt to find adequate supplies. From the early fifteenth century imports into London were waning and Russian prices started to rise as the animal population declined. By the 1460s London merchants were complaining about inadequate supplies and the volume of exports from Novgorod had fallen by about a half, though they were still at the substantial level of about 200,000 skins a year. Other areas of Europe were also nearly exhausted. In 1424 the Scottish kings were driven to banning the export of marten skins and by the sixteenth century the beaver was virtually extinct in southern Europe. The main source of beaver furs—Spain—had dried up and only lower quality skins such as rabbit were available. In the fifteenth century sables were common as far west as Finland but by the late seventeenth century they were confined to Siberia.

By the sixteenth century the only remaining untrapped area was Siberia and it was the continuing demand for furs from western Europe that drove the Russian merchants, using native and Russian trappers, into this largely unexplored area. As in the medieval period in western
Russia, furs rapidly became the main trade in Siberia and the main currency—the price of an iron kettle was the number of sable or ermine pelts that would fit into it—and by the mid-seventeenth century over a third of the income of the Russian state came from the fur trade. The early trappers could hardly believe their eyes. They describe vast numbers of animals and ermine so tame that they would come up to the houses and be caught by hand. As elsewhere the huge numbers encouraged large-scale killing and once an area was exhausted the trappers moved further east to find more animals. By the end of the eighteenth century the fur-bearing animals of even such a vast area as Siberia were virtually exhausted and the Russian traders were turning their attention to the sea otter of the northern Pacific islands. Between 1750 and 1790 about 250,000 otters were killed before the trade collapsed because of overhunting. By the nineteenth century the heyday of the Russian fur trade was almost over. The white fox was nearly extinct but about 20,000 sables, 25,000 ermines, 20,000 red foxes and 2,000 blue foxes were still being killed every year in Siberia.

The virtual extermination of fur-bearing animals in western Europe and the western parts of Russia by the early sixteenth century meant that from the start of settlement in, and trade with, North America the search for furs was one of the driving forces behind European expansion across the continent. At the first contact between the French and the Indians in 1534 the Europeans exchanged their goods for beaver skins and they soon established an organised trade in furs. For a long period the Europeans did not trap the animals themselves but used the Indians to do so and traded the goods the local inhabitants wanted in return for furs. The habits of the beaver made it very easy to trap. They settled in dense colonies and were also sedentary, making it possible for the trappers to concentrate on particular areas. But their low birth rate also made it very difficult for them to recover from overhunting. What the fur traders and trappers preferred to do was exploit an area until it was no longer economic to continue and then move on. For example, by 1600 the region around the St Lawrence river was exhausted as was upstate New York shortly afterwards—beaver were common on the Hudson river in 1610 but extinct by 1640.

By the mid-seventeenth century the trade was well organised in the interior of North America, mainly along the St Lawrence river, and controlled through a series of fortified trading posts. The rivalry between the French and the British Hudson’s Bay Company was intense and ensured a high rate of exploitation. Europeans were also becoming fur trappers as well as traders. (The consequences for wildlife in the area where the trappers wintered could be dire. For example, during the winter of 1709–10 at Port Nelson eighty men consumed 90,000 partridges and 25,000 hares.) The scale of the fur trade at this time can be judged from a series of examples. In just one year (1742) Fort York traded 130,000 beavers and 9,000 martens and at one trading post in Canada in the 1760s the Hudson’s Bay Company was taking nearly 100,000 beaver skins a year. In 1743 the French port of La Rochelle (one of the centres of the trade with Canada) imported 127,000 beaver skins, 50,000 martens, 12,000 otters, 110,000 raccoons and 16,000 bears. Similar figures were common at other French and British ports. It is not surprising, with this level of exploitation repeated in a large number of ports year after year, that by the end of the eighteenth century the animals were driven to extinction in area after area and the North American fur trade was in decline. The number of furs trapped in the Red River area fell by two-thirds between 1804 and 1808 and beaver skin exports from Canada fell from 182,000 in 1793 to 92,000 in 1805.

The American trade was sustained in a last burst through the opening up of new areas for exploitation in the far west and the Pacific coast at the beginning of the nineteenth century. In 1805 when the first American explorers (Lewis and Clark) travelled through the area west of the Mississippi into the Rocky mountains and on to the Pacific they reported that the area was ‘richer in beaver and otter than any country on earth’. Within less than forty years the area would be virtually cleared of both animals and the American fur trade would have nowhere else to go. In 1840, a traveller, Frederick Ruxton, noted the achievements of the trappers: ‘Not a hole or corner but has been ransacked by these hardy men. From the Mississippi to the mouth of the Colorado of the West, from the frozen regions of the north to...Mexico, the beaver hunter has set his traps in every creek and stream.’ Trading was organised in the traditional way with Indian tribes working for European traders in return for European goods and white fur trappers working either independently or for the main firms involved—the British Hudson’s Bay Company or the American, Jacob Astor. Unrestrained competition between them rapidly depleted beaver stocks. In the early 1830s the number of animals killed was already in decline as the beaver neared the point of extinction. By 1831 the beaver was extinct on the northern Great Plains and the trapping effort had to move further west to the Pacific area. Across the whole area overtrapping had reached such a point that yields of furs were down to a quarter of the level expected from new areas. In 1833 the situation was so bad
that the Hudson’s Bay Company issued instructions to its trappers not to hunt in certain areas where the beaver was almost extinct—the instructions were ineffectual. The next year saw the almost complete collapse of the beaver trade in the far west of North America because of overtrapping. By the late 1830s only 2,000 beaver skins a year could be obtained from the whole of the Rocky Mountains area. Beavers were only saved from total extinction by a change in fashion. Beaver skins were mainly used to make hats but prices rose as the supply collapsed and a new craze for silk hats made demand plummet. By 1840 beaver trapping in North America was over. The trappers switched to other furs—500,000 muskrat skins were sent to England in 1842 and 137,000 martens in the early 1850s—but they too were soon exhausted.

By the late nineteenth century the killing of fur-bearing animals, which had gone on across the world as an international trade for at least a thousand years, had reduced the population of many types drastically and over large areas once flourishing species were extinct. As supplies from Russia and North America collapsed and the rarity value of furs increased, the nature of the trade altered. The last, remaining untouched areas were utilised and exotic new species were killed—the chinchilla and ocelot are now virtually extinct in Latin America because of overtrapping. In Australia the platypus, opossum and different types of wallaby were hunted for their fur. The state of Victoria alone was exporting 250,000 skins a year in the early twentieth century and in 1919–1921 Australia sold five-and-a-half million opossum furs and 200,000 koala skins. Once supplies from the wild were no longer available in sufficient quantities, the fur trade came to depend largely on farming rather than trapping: animals were specially bred on ‘fur farms’—80 per cent of the world’s trade in furs now comes from such farms.

The demand for fur and specialist skins was one of the main driving forces behind the hunting of many types of seal. As early as 1610 the Dutch were killing seals along the African coast for their skins but the sealing industry did not develop on a major scale until the late eighteenth century when other species were in drastic decline. It was dominated by western Europe, Russia, Canada and the United States with the main markets in Europe, North America and China. The animals were usually clubbed to death when they were onshore to breed and defenceless. The industry showed the same characteristics as the fur trade—rapid exploitation of an area until the seals were either extinct or so reduced in number that it was no longer economic to hunt them, followed by a move to a new area. In its first phase, between the 1780s and the 1820s, the trade concentrated on killing the southern fur seal which was found in large numbers across the southern hemisphere. One of the first areas to be exploited—and exhausted—were the islands of the south Atlantic. In the 1790–1791 hunting season one American ship took 5,000 skins from the island of Tristan da Cunha and the Falkland Islands and Tierra del Fuego were exhausted at about the same time. In the first quarter of the nineteenth century South Georgia was a major centre of the trade and, in total, over a million seals were killed there. The South Shetland Islands were exhausted by two years’ hunting (one ship killed 9,000 in three weeks and two ships took 45,000 between them in one season). Hunting moved on into the southern Indian Ocean centred on Kerguelen Island. Seals were killed there from the early nineteenth century but by the mid-1820s were extinct. In the Pacific, sealing was centred on the islands off the coast of Chile, in particular Mas Afuera in the Juan Fernandez Islands. One account describes how a single ship killed 100,000 seals in one visit and there were at times fourteen ships operating round the island. In just seven years between 1797 and 1803 over 3 million seals were killed on this one island and the herd was on the point of extinction. When the first Europeans visited Australia and the adjacent region they found large, undisturbed seal colonies but within twenty years these too were destroyed. For example, an onslaught on the seal herd along the Bass Strait killed 100,000 animals in a single season (1805) and reduced the herd to such a level that it was no longer economic to hunt them. On Macquarie Island, first discovered in 1810, 180,000 seals were killed in three years and within a decade the herd on the island was extinct. By the 1820s the southern fur seal had been almost wiped out: it was no longer worthwhile hunting it anywhere in the Atlantic or Indian Oceans. Altogether it is estimated that about six million fur seals were killed in the early decades of the nineteenth century.

In the north Atlantic sealing concentrated on the harp seal which in the autumn and winter migrates south from the Davis Straits to Labrador, the St Lawrence estuary and Newfoundland, where the young are born on the pack ice at the end of February. For ten days the newly born seals have their coveted white fur and they were the focus of the slaughter, although adults were also killed for their coarser fur and for oil. The Newfoundland sealing industry began in the early nineteenth century and by the 1830s about 80,000 seals a year were being killed. At the peak of the trade, in the 1850s, the figure reached about 600,000 seals a year. The introduction of large steamships, which were much more efficient at processing the seals, meant that a single vessel could deal with 20,000 seals a day. The huge herds could not survive
slaughter on this scale for long and by the early twentieth century the industry was in decline. Altogether between 1800 and 1915 it is estimated that about 40 million seals were killed in the area and the herds were reduced to about a fifth of their original size. In the far north sealing (also for harp seals) based on Jan Mayen Island inside the Arctic Circle, was a very brief affair. It began in the early 1840s and at its peak about 400,000 animals a year were being killed. The herds were driven to the point of extinction and by the late 1850s the industry there had collapsed altogether.

Sealing in the north Pacific was based on the northern fur seal, which migrated every year from the Bering Sea to the coast of central California. It mainly stayed at sea apart from coming ashore to breed in the summer — about four-fifths of the animals bred on the Pribilof Islands in the Bering Sea. The first hunters to reach the islands were Russians, who originally concentrated on the more valuable sea otter. When these had been killed they switched to the fur seal, which they proceeded to slaughter in such vast numbers (in 1797 127,000 animals) that they were soon piling up far more bodies than they could sell. In 1803 there was a store of 800,000 skins on the islands, 700,000 of which went rotten and had to be destroyed. By the 1820s the seals were so reduced in numbers that kills were down to about 7,000 a year — by then a total of about two-and-a-half million had been killed on the Pribilof Islands. The Russians next turned their attention to seals on the mainland coast and by the time Alaska was sold to the Americans in 1867 about four million seals had been killed in the area. In the meantime the seal herds on the islands had recovered and in the first year of American control 250,000 seals were killed on just one of the Pribilof Islands. Numbers fell rapidly but the Americans continued to kill about 100,000 a year until the 1890s when the number fell to about 17,000 a year. By 1910 from several millions the herds on the Pribilofs had been reduced to a mere 130,000. As the demand for seal skins was still high, the hunters had turned to the more difficult task of hunting the animals at sea. Between 1870 and 1910 another four million seals were killed in this way.

The elephant seal, the largest of the seals, was hunted not for its fur or skin but for its oil. It was found in large herds, but only on a few islands in the seas around the Antarctic and off the west coast of North America. It became the prey of whalers anxious to supplement their catch when the number of whales was declining. About one million of these seals were killed in the south Atlantic in the nineteenth and early twentieth centuries and the population there was only saved from extinction when both Kerguelen and Macquarie Islands, where the last few animals survived, were turned into nature reserves. In total probably about a quarter-of-a-million elephant seals were killed along the coast of California. Off that coast large numbers of elephant seals were still found as late as 1846, but a scientific expedition sent out in 1884 to report on the state of the herds found none at all. In fact a small colony of about twenty had survived and since then the animal has been officially protected and stocks have recovered somewhat. Sealing still continues around the world but at a very much lower level than in the past because of the heavily reduced stocks, a greater degree of protection given to the animals and an increasing consumer boycott of furs and skins, in part prompted by the sight of young seals being clubbed to death. It is difficult to estimate the number of seals killed worldwide at the height of the trade between the late eighteenth century and the first decades of the twentieth century but the total was probably of the order of sixty million.

The killing of walruses on an extensive scale began much earlier than the sealing industry but also petered out much earlier — after some three centuries of exploitation numbers had been reduced drastically. They were killed for oil, skin and the ivory from their tusks. In 1456 walruses could still be found in the Thames and as late as the mid-nineteenth century they were still common in both the Hebrides and the Orkneys. Now the total stock around the whole of the north Atlantic is no more than 25,000. The trade followed the same pattern of peripatetic thoroughness in its approach to hunting. For example, in the seventeenth century the English Muscovy Company eliminated a herd of 20,000 walruses on Bear Island, south of Spitzbergen, inside ten years. At the same time the herds that inhabited the area around the mouth of the St Lawrence river were destroyed — about 250,000 animals. Hunting then moved on to Labrador and the Arctic area but by the 1860s nearly every walrus in this area too had been killed. The last significant herd in the north Atlantic area survived on Spitzbergen until the 1920s when they were also hunted to extinction. In the latter part of the nineteenth century walrus hunting was mainly concentrated on the herds in the north Pacific. Between 1868 and 1873 about 85,000 a year were being killed but this rate of exploitation was short-lived. By 1891 the walrus was also extinct on the Pribilof Islands. The total number of walruses killed is unknown but the best estimate for the slaughter in the nineteenth century suggests a figure of about four million.

Although the trapping of animals for fur and the slaughter of seals and walruses were conducted on a massive scale, the most prolonged
attack by humans on any single species has been directed against the whale. Whales are some of the largest animals to have lived—a sperm whale can weigh about 100 tons and measure over 100 feet long. They have few predators apart from killer whales and humans, and natural populations would therefore have risen to high levels despite their position at the top of the food chain. Although whales are long-lived (many survive into their seventies) their reproduction rate is slow—about one to two per cent a year, and they take a long time to recover from any attack. Sustained killing of whales, particularly if concentrated on the breeding grounds, could very easily drive a local population to extinction. Whales fall into three main types whose characteristics have helped determine the development of whaling. The right whale (of which there are three sub-types—southern, northern and bowhead or Greenland) is slow and easy to catch. The fin whales (or rorqual from their Norwegian name), which include the blue, fin, humpback, sei and minke whales, are much faster and more difficult to catch. The sperm whale is toothed and particularly prized for the spermaceti found in its head. Whales were hunted less for their meat (except in the long established coastal fishery of Japan where it was used to supplement the shortage of domesticated animals) than for their oil, normally boiled down from the blubber. Before the rise of the gas and petroleum industries in the nineteenth century whale oil provided one of the major sources of lighting available throughout the world (the sperm whale produced the highest quality candles from its spermaceti). Millions of candles were manufactured from all kinds of whale oil and London even had 5,000 street lamps lit by whale oil in the 1740s. As well as providing virtually the sole source of lubrication for industrial machinery, it was also used to clean coarse woollen cloth. An important supplementary part of the industry was the use of whalebone in corsets, umbrellas, whips, fishing rods and cutlery handles.

The history of whaling shows the same main characteristics as sealing and the fur trade. An area was exploited, driven by severe competition between the fleets of different nations and between individual whalers, to maximise immediate gains without any thought of conserving stocks, until either the whales were extinct or their pursuit was no longer worthwhile economically. The whaling fleets then moved on to exploit a new area. Until the eighteenth century the whales concentrated almost entirely on killing the right whale (so-called because it was the 'right' whale to catch). Their slow swimming speed meant they could be caught, especially in their breeding grounds, with the primitive technology then available. They could be chased in rowing boats and

when harpooned with barbed spears thrown from the boat their speed was not sufficient to overturn the boat and the whalers could attach more ropes and hang on, for days if necessary, until the animal died from exhaustion. When dead they floated and so could be towed ashore for processing. Right whales had a 12–18 inch layer of blubber (ten times that of a sperm whale), which produced a large quantity of oil and they also produced about a ton of whalebone per animal.

The European whaling industry has a long history—whales were hunted and exterminated in the Mediterranean before the fall of the Roman empire. From about 900 it was concentrated in the Bay of Biscay and dominated by ports along the northern Spanish coast. Even this relatively small-scale industry so reduced local whale stocks that by the fifteenth century the whaling ships were already exploiting new grounds off Newfoundland as the Biscay whales neared extinction. By the sixteenth century the Biscay industry had collapsed, and the right whale in the area was extinct. A new large-scale whaling industry developed, dominated by the Dutch, and with the Germans and English also playing a large role, concentrating on the island of Spitzbergen where right whales had their breeding grounds. From about 1600 they were slaughtered in large numbers, young ones and pregnant females included. Within twenty-five years the whale population had virtually disappeared and the hunters were forced to turn further afield towards Greenland and along the migration routes of the whales. Arctic whaling was a technically more difficult operation than killings in the bays around Spitzbergen, since the whales had to be processed at sea alongside the ships. By the end of the eighteenth century it employed about 10,000 men, involving several hundred vessels and the slaughter of about 2–3,000 right whales every season.

The American whaling industry began about 1650 and initially concentrated its efforts along the eastern coast of North America. Stocks there were exhausted by about 1700 and the whalers were forced to move further afield to Labrador and the Davis Straits. The number of vessels involved rose rapidly—the major whaling port of Nantucket in New England had twenty-five whalers in 1730 but over 130 by the end of the century. By the end of the eighteenth century stocks here, too, were in severe decline and immature juveniles were being killed, thereby ensuring that any recovery in numbers was almost impossible. By 1830 the Arctic whaling for right whales was on the point of collapse and it was forced into the most difficult areas such as Baffin Bay when the whales died out in the accessible regions and catches everywhere fell drastically.
The main change in the industry in the eighteenth century was the move to killing sperm whales, which began off the American coast in 1712. The sperm whale produced less oil than the right whales but its spermaceti could be stored without processing and this, together with the high value of the end product, made long voyages economically feasible. The whalers were now able to extend the hunt into the southern Atlantic, concentrating first on the areas off the southern African coast (after 1763) and Brazil (after 1774) and eventually moving into the Pacific. Many of the first settlements in Australia and New Zealand (especially Hobart on Tasmania) were dependent on whaling and vessels from both Europe and the United States were soon hunting across the Pacific. At the peak of the trade, about 1840, the Americans alone had over 700 vessels operating in the Pacific and every whaling ground from 88°N to 55°S was fully occupied. The sperm whale hunting area stretched from California to Japan, from Peru to the Gilbert Islands and from Chile to Australia. On average each vessel killed about 100 whales a season, which would mean that the Americans alone must have been killing about 70,000 a year in the Pacific. With other nations operating on a similar scale, overhunting brought the industry to the point of collapse. In the 1850s the north-west coast of North America had supported about 600 whales every year, but a decade later hunting ceased as the whales neared extinction. By 1880 the once thriving Pacific whaling industry was reduced to a few areas off the coasts of Peru and Australia. By the latter part of the nineteenth century both the right and sperm whale populations of the world had been hunted to the edge of extinction. By the late 1860s, after a century of relatively limited killing, the right whale, which once swam in the world’s oceans in hundreds of thousands, only survived in small populations of about 1,000 in the southern hemisphere, 400 in the north Pacific and a few hundred in the Atlantic.

The whaling industry might have shared the same fate had it not been transformed in the late nineteenth century by a series of technical advances. The most important developments were the introduction of fast, steam-powered boats and the explosive harpoon (which detonated inside the whale). These inventions made it possible to chase and kill the fast swimming and deep diving roqual whales, which until then had been almost immune to human attack. The invention of the factory ship, which processed the whales at sea and stored the oil on board in vast quantities, also extended the length of time the whalers could remain at sea. Although the market for the traditional uses of whale oil — lighting and lubrication — and that for whalebone in corsetry — were in decline due to the use of petroleum based products and changes in fashion, a new market developed — processing whale oil into soap and margarine. The attack on the roqualus using the new technology showed the same basic pattern as in the past. First the more readily accessible areas were denuded of whales, then gradually the ships moved into more distant and difficult waters. The first whales to be killed were the largest, such as the blue and the humpbacked, since they offered the quickest returns. When they had been driven to the point of extinction smaller whales such as the sei and minke, which involved more effort for a lower amount of oil, were hunted.

The new technical advances were made, and energetically implemented, by the Norwegians in the 1870s. Within a decade they had eliminated the roqual whales along their coastline before moving further afield towards Iceland and the Faroes. By the end of the century they were killing about 2,000 whales a year in the area. Shortly after 1900 the European whaling grounds were exhausted and the Norwegians, together with the British and other nations, were moving into the last untouched area — the south Atlantic. In these waters the initial catches were large but it rarely took much longer than a decade before new hunting grounds had to be found. The fleets were first based around south Georgia, where in 1906–11 the Norwegians killed some 6,000 humpback whales every season. By 1913 numbers had fallen so much that only 500 a year could be caught and by 1917 the humpbacks were exhausted and the whalers turned to other species. By the mid-1920s blue whales were scarce around south Georgia. The whaling fleets moved on to the south Shetland Islands, the Ross Sea and the Antarctic and the breeding grounds off southern Africa, Madagascar and Peru. New entrants into the international whaling industry such as Japan and Germany sent fleets to the southern oceans which increased the competition still further. By the 1930s there were about 200 whaling ships operating in the Antarctic area, killing up to 40,000 whales a year.

After a quarter of a century of sustained attack stocks of all species were in steep decline and the fleets were reduced to hunting at sea on the migration routes or the less productive killing of smaller whales. (Although the number of factory ships increased by almost 60 per cent in the 1930s the amount of oil recovered rose by only 11 per cent.) The period since the 1930s has seen a major threat to the very existence of the whales and an almost total collapse of the international industry. In 1951 the boats in the Antarctic alone were still catching two-and-a-half million tons of whales but by 1979 the total world catch was only 200,000 tons. The industry became steadily less profitable as it turned
to hunting the smaller sei and minke whales. Whereas in 1933, 28,900
whales produced 2.6 million barrels of oil, in 1966 double that number
(57,900) produced only 1.5 million barrels of oil. The statistics for each
species of whale vividly illustrate the state of the whale population and
of the industry. In the 1930s 170,000 blue whales were still being killed
every year, thirty years later the annual catch was down to about 7,000
and by the 1970s it had fallen to just twenty-three. Humpback whales
followed the same pattern, falling from 27,000 a year in the 1930s to
about 200 by the early 1980s. The sperm whale rose more than
ten-fold from 20,000 a year in the 1930s to nearly 250,000 a year in the
1960s. Within twenty years it had dropped to less than 5,000 a year as
the species was hunted to near extinction. To compensate for the fall in
the stocks of these species the fleets turned to the fin whale; the catch
doubled between the 1930s and the 1950s to reach 280,000 a year. But
this rate was unsustainable and by the 1970s the numbers killed had
fallen to 22,000 a year. The annual sei whale catch rose from about
10,000 in the 1940s to a peak of 250,000 in the 1960s but fell drastically
in the 1970s. As whale stocks fell and smaller animals had to be hunted,
and as competition for the remaining stocks became fiercer, the whaling
industry encountered severe economic difficulties worldwide. By the
early 1950s many whaling companies were bankrupt and some
countries ceased whaling altogether — the British industry folded in the
early 1960s.

Although it was clearly in the long-term interest of the international
industry to devise a scheme to control catches so that whaling could
continue, albeit on a reduced scale, this did not happen. Instead there
was intensified competition for the falling stocks as the fleets sought, as
they had done in the past, to maximise short-term gains. The result of
this uncontrolled competition was a disaster not just for the whales but
also for the whaling industry itself. The idea of establishing quotas to
control the level of killing was first mooted in the early 1930s but
nothing was done before the establishment of the International Whal-
ing Commission (IWC) in 1946. As a grouping of whaling nations, its
members favoured a continuation of the slaughter even when scientific
evidence about the dangerous decline in whale numbers was in-
controvertible. Quotas were set but they were so high that most
countries could not catch enough whales to meet them, and they failed
to restrict the killing. Of the total number of whales killed in the
Antarctic in the first seventy years of this century more than half
occurred in the twenty years after the IWC was established. No
effective controls on the type of whales killed were imposed — in 1961
over 70 per cent of the blue whales killed in the Antarctic were immature
and this unrestrained slaughter, by stopping the whales breeding,
guaranteed that numbers would continue to fall drastically. Although
pressure was growing on the IWC to bring in more effective measures it
did not move quickly enough or far enough. A three-quarters majority
of members was required before a new policy could be adopted and
even then individual states were not bound by its decisions. This meant
that those nations which were determined to continue whaling, in
particular Japan, Iceland, Norway and the Soviet Union, were in a
strong position to delay or prevent control measures. In the mid-1970s
quotas were set for particular species designed to provide long-term
protection, but the data on numbers and reproduction rates on which
the quotas were based was inadequate and too favourable to the
whalers. Countries such as Japan were also using other nations outside
the IWC to do the hunting for them, thus circumventing the restric-
tions. Finally, under continuing external pressure, the IWC agreed in
1982 to a four-year moratorium on commercial whaling to start in the

However, the 1982 IWC decision allowed ‘scientific whaling’ to
continue during the moratorium. The idea of ‘scientific’ whaling
(involving the killing of whales supposedly as a small-scale operation for
the purpose of providing information about numbers and reproduction
rates) had begun in 1962. When the four-year ban on commercial
whaling was introduced, the three nations still left with a whaling
industry — Japan, Norway and Iceland — seized on ‘scientific’ whaling as
a way of keeping their industries alive. The Japanese Joint Whaling
Company was miraculously transformed into the Cetacean Research
Institute and its whaling ships suddenly became research vessels. In
1988 as many as 10,000 whales a year were being killed for ‘scientific’
purposes, although the value of the ‘research’ was far from clear and
many of the animals ended up as meat in Japanese restaurants. For the
whaling countries the main aim of the ‘research’ was to demonstrate
that commercial whaling could be restarted at the end of the moratorium.
The 1990 IWC meeting did not agree to end the moratorium but the
pressure to resume commercial whaling remains strong.

The history of whaling demonstrates the inability of those involved
to conserve the whales. Instead all the economic pressure worked to
maximise short-term gains with little or no concern for the future, even
in the face of mounting evidence that the whales were being killed at an
unsustainable rate. The same sorry saga happened in sealing, the fur
industry and also in many of the world’s fisheries — in most cases
industries were extremely reluctant to react to the rapidly diminishing resources on which they depended. Indeed humans have for centuries acted as though supplies of animals were limitless or as if it didn’t matter if they ran through the supply. The consequence has been a monument to human short-sightedness. Not only have the industries involved declined but there has been a catastrophic loss of wildlife around the world. Across large areas species have become extinct and overall their numbers have fallen dramatically. Human actions, whether deliberate through hunting or indirect through the process of expanding settlements and clearing wild areas, have drastically affected the ecosystems of the world. Many species have died out and will never be replaced, others will probably never recover from the depredation. It has left an impoverished world.

A reaction to this widespread slaughter developed at the end of the nineteenth century with the rise of movements aimed at conserving the world’s remaining wildlife. One of the earliest was in the United States and led to the creation of special wilderness areas such as Yellowstone National Park where development and exploitation was prohibited. Other countries moved much more slowly – National Parks were established in Britain in the 1940s and even later in other areas and it was not until the 1980s that Britain designated a few hundred small sites as of special scientific interest. Some of the more outstanding habitats such as the Great Barrier Reef off Australia, the Galapagos Islands and the Serengeti park in Tanzania, have now been designated as reserves but most of the world’s ecosystems remain unprotected. Even those that are protected still face problems. In Britain major developments inside the National Parks are not prohibited, sites of special scientific interest can be destroyed and in many Third World countries a shortage of resources means that effective management is impossible and killing of the animals by poachers has continued. In many instances the National Parks are little more than lines drawn on a map and have little impact on the ground.

Part of the growing movement to conserve wildlife and the natural world has been the increasing importance of citizens’ organisations and lobbying groups trying to change national policies. In the United States bodies such as the Audubon Society and the Sierra Club and in Britain the Royal Society for the Protection of Birds and nature conservation trusts have attempted to preserve some individual species or have bought small areas in order to protect particularly important habitats. In the last twenty-five years or so global organisations such as the World

Wide Fund for Nature, Friends of the Earth and Greenpeace have raised large sums of money and campaigned to preserve the world’s natural heritage (as well as on many other ‘green’ issues). These groups have played a major part in influencing public opinion and governments against activities such as whaling and sealing and towards conservation measures.

In the last two decades there has been a series of international conventions and treaties designed to safeguard important sites and restrict trade in endangered species. The convention on the world’s cultural and natural heritage is intended to protect the most important sites in the world and offers governments small sums of money to take the necessary action. The convention on wetlands is intended to do the same for sites particularly important for waterbirds. CITES (the Convention on International Trade in Endangered Species), signed by over eighty countries since 1973, prohibits commercial trade in several hundred of the world’s rarest species. The problem with these international agreements has been that although countries have been willing to sign them, they have been less willing or able to enforce them. Many have turned a blind eye to the continuing trade in items such as crocodile skins, rare furs, ivory and rhinoceros horn.

The growing movement for conservation has succeeded in raising public awareness and has, on a small scale, achieved a number of important goals. But it has been overwhelmed by the tidal wave of destruction that continues to sweep across the world. In the twentieth century the rate of species extinction has increased significantly. Between 1600 and 1900 an animal species was made extinct about once every four years. By the 1970s this had risen to a rate of about 1,000 a year. At present about 25,000 species of plants, 1,000 species of birds (10 per cent of the world’s total) and over 700 species of animal (including particularly vulnerable ones such as tigers, jaguars, leopards, cougars, cheetahs, ocelots, twenty-three types of whale, four types of rhinoceros, ten bear and two panda species, the mountain gorilla and the African elephant) are on the verge of extinction. In the tropical forests about fifty species of plants and animals are being eliminated every day. At this rate it is estimated that in the 1990s about 1 million species (almost 20 per cent of the total in the world) will become extinct.