

ENVIRONMENTAL CONSEQUENCES OF NEW ANTHROPOGENIC ECOSYSTEMS

Medieval Europeans set out to transform their landscapes largely as sites for producing cereals, but also for non-cereal agricultures, and even on grounds that had little at all to do with material outputs. Yet in all instances they colonized nature to create new anthropogenic ecosystems. The interventions had deep environmental effects. Human actors meant to bring about environmental change and accomplished their purpose, but building the new medieval agroecosystems also had unintended consequences.

The intent in the clearance of woodlands, drainage of marshes, and irrigation of dry land was human colonization of natural systems. In modern ecological terms, the purpose was to create new niches where humans would capture a larger share of primary biological production. In the course of the central Middle Ages, in order to obtain what they defined as food, medieval Europeans replaced old natural ecosystems with low annual productivity relative to the standing biomass of long-lived organisms (mainly trees) with new artificial ecosystems containing a lower biomass of short-lived pioneer plants (mainly grasses). With the transformation from the relatively natural to the more anthropogenic, a high diversity of producing and consuming organisms gave way to a low diversity, ideally a monoculture, of annual cereal grains. A once diverse and complicated food web was replaced with a short food chain comprising a few domestic herbivores and many, mainly plant-eating because mainly peasant, humans. Such ecosystems with low diversity of short-lived organisms and truncated food webs are characteristically unstable. They require

continued inputs of energy to keep them at the pioneer stage. Annual grasses grow on bare dirt. They live for a year or two, they cover the soil, and then in nature they are succeeded by other kinds of plants. Those who would keep on growing cereal grasses have to keep taking the land back to the bare dirt. Intensive cereal growing demanded more human labour and more natural plant nutrients throughout the annual production cycle than had earlier more loosely manipulated mixed agropastoralism.

Very large unintended consequences accompanied the creation of the new medieval agroecosystems. The very process of cutting and uprooting trees and converting open woods to permanent fields destabilized relations between soil, plants, and water. In the late thirteenth century a Dominican in the town of Colmar on the Rhine wrote tellingly about what had changed in the area between the Vosges mountains and the river during his own lifetime. He said the trees had been removed that once grew along the mountain slopes and the loss of woody cover had resulted in more rapid and erratic runoff. Alsatian streams now alternated seasonally between springtime floods and dry beds in summer droughts. This he attributed to the clearances.

An erratic runoff regime was simply the first element in a causal chain connected to transformation of the landscape. Human colonization on new lands and intensification of production on old ones initiated and accelerated large-scale soil erosion and deposition. The unintended results affected new landscapes even at some distance from the sites of direct human intervention. Broken vegetative cover coupled with soil and nutrient loss exposed large expanses of soil surface for seasonal removal. This most often occurred by water which then deposited the sediment further downstream. A three-course rotation leaves approximately seven months between the time a winter grain is harvested and a new spring course planted. It is about fourteen months from the harvest of a spring grain, through the year of fallow, until sowing of winter grain on that field. Were that fallow left bare and open, and especially were it ploughed, the soil surface would become vulnerable to being washed away by precipitation and the ensuing flow of water.

Pioneer farms are especially susceptible to environmental degradation because newcomers lack familiarity with local factors of risk. Settlers undertake to transform their environment and necessarily undergo an adaptation process while learning the limits of their new

home, its climate, soils, plants, animals, and even micro-organisms of which they may be totally unaware. Commonly one well-attested result is major erosion in recently cleared regions.

Precisely this pattern of soil loss is visible at representative sites in those European areas where and when medieval clearances and intensification were actively creating new permanent arable land. A pair of lakes in the French Alps make a telling case. At Lac Paladru to the north of Grenoble a falling water level enabled free 'peasant-knights' to settle on the shelving shoreline in about 1003 and clear the land for arable and pasture. At this point well-dated sediment cores taken from the lake bottom abruptly contain particles of loam and organic matter eroded from the broken soil. By 1035, however, the lake level was again rising, possibly because clearance increased the rate of runoff, and a few years later the settlers gave up, letting the slopes revert to woodland succession. Further north in Savoy, bottom cores taken from the larger Lac d'Annecy show a similar jump in sedimentation, here later because coincident with the thirteenth-century decision of local monasteries to convert their lakeside lands from woodland to arable exploitation. With trees removed, soil flowed from the bare ground surface into the lake and settled to its bottom.

A more general view around the western Mediterranean basin shows the cumulative effect of such small-scale clearances, drainage, and irrigation which transformed local hydrologies. From the twelfth century onwards there is well-demonstrated coastal deposition and marsh formation along the shores of Sicily and parts of southern peninsular Italy where this had not previously been the case. Along the Gulf of Lions on the French Mediterranean shore embayments that had been stable since Roman times were now quite suddenly filled in or turned into lagoons as a consequence of deposition of soil eroded from newly cleared lands.

Northern European alluvial zones and estuaries reveal unintended medieval changes that were abrupt, dramatic, and followed closely on regional clearances. Rates of alluviation in the upper Thames valley peaked during late Anglo-Saxon and early Anglo-Norman times, the eleventh to thirteenth century exceeding all other post-glacial periods. Consequent shifts in British river channels followed. Similarly in the Rhine basin the rate of alluvial deposition hit a maximum in the 1100s, coinciding with new agricultural disturbances there. More generally in Germany, geomorphologists find that soil erosion had

for several prior millennia averaged less than 5 mm per year. But after the woodland cover was reduced to a mere 10 per cent of surface area by the end of the thirteenth century, extreme precipitation during 1313–19 thrust this alluviation rate up to five times the annual mean, in other words, 25 mm per year or a hand's span of soil loss in less than a decade. Still further east on Europe's northern plain, the large-scale clearances carried out at the upper end of the Vistula basin in southern Poland during the 1200s changed the hydrographic balance of the entire watershed. At its lower end the silt and nutrients that had washed off new inland fields came in the course of a century to fill the historic bay between Gdańsk and Elbląg, create a chain of offshore barrier islands, and then build those islands into a solid barrier spit with a lagoon behind. The physical changes to the shoreline and likely accompanying changes in water chemistry which resulted from this pulse of erosion and deposition contributed to the commercial failure around 1300 of the herring schools which had for several previous centuries spawned and been harvested along coastal Pomerania. Those schools now vanished.

The fate of south Baltic herring suggests how transformations in the physical landscape also provoked changes to biodiversity. A switch from woodland to permanent fields altered the runoff regime, which affected soil erosion and deposition, and all this affected the habitat for animals. Loss of woody vegetation transformed terrestrial habitats and altered carrying capacity for wild and domestic beasts. Of course no biological field surveys were undertaken at the time, so relevant indicators can only be pieced together from tiny scraps of both material and written evidence. It is, for instance, telling that modern studies of bird life around England's last surviving open-field village, Laxton in Nottinghamshire, found fewer bird species and only half the density of birds on what were still open fields of medieval type as compared with nearby areas with the mixed plant communities more characteristic of ancient countryside or what had existed before that. Likewise remains of woodland birds dominate in archaeological sites around Madrid dating to the fifth to twelfth century, but lost importance in the later Middle Ages after the re-Christianization of central Spain with its emphasis on dry farming of cereals and long-distance transhumance of sheep. Animals preferring other habitats could, however, gain. Evidence of great bustard, a ground bird of open grasslands, increased at this time in both England and Pannonia. Likewise, among domestic livestock, sheep and goats, creatures well adapted for living in the

interstices and around the edges of mixed arable landscapes, came increasingly to supplant the woodland-dependent pig. Pigs would have to find a new kind of habitat. Changes to wildlife subject to purposeful hunting will be explored in the next chapter.

The overview of medieval landscape formation finds a process driven by the wants and needs of the few powerful and of the many poor. The process – call it colonization – transformed medieval Europe into a mosaic of artificial ecosystems, most of them designed to maximize cereal production. Grain fields interspersed with meadow, pasture, and large permanent villages replaced earlier mixed-density multi-use woodland where scattered islands of arable had supported small, dispersed, and generationally transient human settlements. Present-day analytical perspectives can also reconstruct the large-scale motives for this colonizing intervention: both cultural and economic considerations evidently applied. Within the larger process, particular cultural and natural conditions resulted in local and regional diversity of great historical longevity.

The outsider observer's etic perspective provides less access to how participants themselves experienced and represented the change. A search for the emic comes up with disappointing hints and some promising proposals. Occasional *exordia* of charters or chroniclers' references reflect elite awareness of purpose. Polish texts use the concept of *melioratio terrae*, 'improvement of the land', to encompass clearance, settlement, and agricultural development; monastic ideology lauded the *deserta* made into *hortus*. Comparable intent is but latent in privileges offered to new settlers by the archbishop of Bremen in 1106, in twelfth-century Castilian charters of *población*, and in the 1184 customal for Beaumont in the Ardennes, which became a regional prototype.

Many Anglo-Saxon charters contemporary with active clearances in England use the vernacular in their boundary clauses, making the landmarks named in perambulations fully accessible when read aloud in the language of local people. Similar clauses elsewhere, even when composed in Latin, are rich repositories of local vernacular place names reflecting thorough awareness of the interpenetrated natural and human in the landscape. Trees and brooks, ditches and roadways, as well as purpose-set stones or crosses, delimited physical and social space around twelfth-century Scottish Melrose and early thirteenth-century Silesian Kozańów, village of the duke's grooms. Cartularies

assembled by corporate lords from central France to central Silesia organized literate thoughts about the past of their landed possessions. From such references in record and narrative texts Nicholas Howe, a specialist in Anglo-Saxon literature and culture, inferred a deep and concrete awareness of place and change among the English, who saw their community identified through its providential migration to Britain, which they had subsequently made into their 'homeland' (*eþel*). Although rooted in land(scape?), the literate concept paid little regard to contemporary human constructions and uses, which it either tacitly assumed or dismissed as ephemeral.

Like the boundary clauses, illuminated labours of the months seem to connect to people working in a humanized nature, depicting their agricultural routines and occasionally even tasks of assarting. The sequences and seasonality even of art crafted in northern workshops, however, remained stereotypical representations of Mediterranean practice and even pagan classical tradition long after northern land use had been thoroughly adapted to its different environment.

The investigator of the drained lakes in Languedoc, Jean-Loup Abbé, argues that each development project manifested a newly ordered and rationalized world, one of surveyed fields oriented towards cereal production in a systematic and orderly way. Open to question is the degree to which Abbé's own (and convincing) understanding of the new landscapes reflects what may have been in the minds of the people who worked to make them. Likewise Massimo Montanari, writing about Italian landscapes of the central Middle Ages, has drawn a clear contrast between the ordered world of the emergent city with its city-centred countryside and the disordered world of nature. But in a certain paradox, that disordered world of nature also provided to contemporaries a new restful perspective different from the stressful city. Was this in the minds of men and women who broke the stony ground at Villafranca Veronese in the 1180s? A generation later Icelandic politician-poet Snorri Sturluson looked back in his *Egil's Saga* with nostalgia for a mythic idyll of tenth-century resource abundance in contrast to the more densely populated and managed landscape Icelanders had made by the early thirteenth.

The need is plain to explore contemporary environmental perceptions and programmes behind the medieval transformation of European landscapes. Wide space beckons scholarly investigation of how medieval Europeans understood what they were creating

through their work in nature. That the effort is rife with methodological pitfalls has already been amply lamented.

The next two chapters shift the focus from acts of landscape formation to the longer-term problem of sustainability, the implications of medieval Europeans operating their evolved systems. How for generations were they capable of maintaining productivity in the agricultural sector with its inherent pastoral adaptations, in their use of those woodlands which had survived the great clearances, and in their exploitation of wild resources? Thereafter attention turns to relations between humans and nature in the use of energy and in the manufacturing and urban sectors which engaged a rising, though always small, share of medieval populations, activities, and environmental impacts.