# SLASH AND BURN EXPERIMENT

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*At the Butser Ancient Farm Research Project in Hampshire, a slash and burn experiment has been carried out on a limited area of cleared old woodland. The purpose was to examine the comparative yield performance of emmer wheat on burned and unburned plots within an artificial clearing and thereafter the natural plant regeneration. The growing experiment ran for four seasons by which time the yield return equalled the seed sown. This stage corresponded with the drought of 1976 and does not necessarily reflect the real final stage. It was, however, the logical point at which to commence the study of the natural regeneration of the flora on the plots. This paper presents the results of the growing period and documents the first season's regeneration*.

There has always been a deep fascination in the transition of human society from a hunting-gathering economy to an agricultural economy. The transition occurred independently and at different times in different places throughout the world. Clearly, it was the greatest advance made by mankind and justifiably it has received considerable practical and theoretical attention. Undoubtedly, a combination of factors led to the step being made, the most important of which was the emergence of a suitable crop which could he exploited to provide a storable food supply. Precisely how and when the transitions occurred in Western Europe is a continuing source of debate among naturalists and archaeologists and is likely to remain so. It would seem that the collection of seeds from wild grasses could ultimately have led to their deliberate cultivation. Of these grasses the most notable is Einkorn which has been recovered from excavations in its wild form, *Triticum boeoticum* and its 'domesticated' form *Triticum monococcum* . Einkorn has been recovered from archaeological contexts at a large number of sites including Ali Kosh, Iran, c.7000 B.C., Jarmo (Iraq) c.6750 B.C., Çatal Hüyük and Hacilar (Anatolia) c. 5700 B.C. Einkorn is still grown today but as an appreciable crop only in Turkey, where it is used primarily as a feed for livestock. There is some doubt about its having been exploited for making bread since its milling and baking qualities are fairly poor. It is best used after roasting as a kind of potage. Its keeping qualities and retention of nutritive values are similar to other cereals.

However, the most important wild 'grass' that was collected and thereafter domesticated was *Triticum dicoccoides* or wild emmer. It is believed that at some time in the eighth millennium B.C., a spontaneous cross occurred between wild Einkorn (*Tr. boeoticum*), a diploid species, and a kind of goat grass (*Aegilops speltoides*) which is also a diploid species, resulting in wild emmer (*Tr. dicoccoides*), a tetraploid species. Recent research suggests that *Tr. uratu* rather than *Aegilops speltoides* was involved in this cross (Johnson 1975). In its domesticated form, *Tr. dicoccum*, it formed the most important wheat of the Near East and Europe throughout prehistory. It is a much heavier yielding crop than Einkorn, although it is extremely difficult to thresh. Indeed, despite the appearance of naked free-threshing wheats as early as the sixth millennium B.C., emmer was maintained as the major crop in Egypt and elsewhere well into the Roman period, to be supplanted by spelt (*Tr. spelta*), a hexaploid species. Spelt is thought to he the product of a further spontaneous cross between Tr. dicoccum and a third wild grass, *Aegilops squarrosa*, which perhaps occurred on the northern slopes of Caucasus or in the Crimea sometime in the second millennium B.C.

Several tetraploid wheats derived from emmer are still cultivated. These include Persian black wheat (*Tr. persicum*), macaroni wheat (*Tr. durumm*), Egyptian cone wheat (*Tr. pyramidale*) and, most interesting, rivet wheat (*Tr. turgidum*). This last was the most popular wheat in Britain in the sixteenth and seventeenth centuries. Its major characteristics are a heavy yield and a high tolerance of poor soils.

Emmer wheat, therefore, is the cereal which formed the staple crop of, if not the prime motivation for, the transition period. This information, however, is only the beginning. There remains the fundamental question of how the transition was engineered. It is, in many ways, far too easy to speak of the domesticated forms of Einkorn and emmer and still not be aware of the processes involved. The theory of arable agriculture is relatively simple to understand. The intended crop is sown in a prepared seed bed, subsequently protected from competition by other plants and herbivorous animals in order to maximise the yield and then harvested. Thereafter, the seed bed is re-prepared for a second crop or else abandoned and another created.

The 'how' of this transition stage is, therefore, extremely complex and has attracted considerable attention. The attention has been focused largely upon the tools of the process, the harvesting implements particularly. There has been a great deal of work carried out on stone sickles with special reference to the glossing effects brought about by cutting grass and straw. There is a good reason to question the so-called stone axe and perhaps to consider these objects as mattock hoes directly comparable to the stone bladed mattocks of the middle-woodland period American Indians. Much attention has been paid to the capabilities of stone axes for chopping down trees. However, there has been remarkably little attention paid to the most significant element, that of the crop itself and its cultivation.

Inevitably, the questions directed toward understanding the production of either the tools and artefacts or the crops themselves involve experiment. It is only by trying to use the tools or their exact replicas or by carrying out the physical processes considered to be necessary that any advances may be made. However, the simplistic approach is fraught with potential and real error. An experiment must be formulated on sound scientific principles with a total awareness of all the limitations involved. The results of an experiment, in order to be acceptable as valid, must be achieved under the most rigorous discipline. Further, an experiment needs to be replicated as many times as possible in order that the results should provide statistical validity. Some of the experiments reported to date are best described as preliminary, the majority are better understood as mere demonstrations. In experimenting with tools, either original or copies, the major variable omitted from nearly all calculations is that of skill or expertise.

One major experiment examining the transition process to agriculture in north-west Europe has been carried out in the Draved forest in South Jutland, Denmark (Iversen 1956). The initial interpretation, based upon the pollen record, suggests that after the last ice age when vegetation was emerging, the Danish countryside was still open and exploited by the hunter-gatherers. Then the forests grew and became dense, reducing the game habitats and consequently the area was abandoned by man. Some thousands of years later man appeared again, this time cutting down the trees of the primeval forest and growing crops and grazing animals in the clearings. The tree pollen declined in favour of herbaceous plants and cereals. Soon after, the pollen record indicates the growth of new tree species, willow (*Salix alba*), aspen (*Populus tremula*), birch (*Betula*), hazel (*Corylus avellana*) and new ground flora species, grasses (*gramineae*), white clover (*Trifolium repens*), sheep sorrel (*Rumex acetosella*), sheep's bit (*Jasione montana*) and other allied species. A further phase follows with a re-establishment of the forest with oak (*Quercus robna)* as the predominant species. The hypothesis offered for the above pollen evidence is that man cleared areas of the original forest, burned the wood and brush, planted fields and grazed animals on the adjacent areas. The occupation period was short, perhaps about fifty years, after which they moved on to clear another area (Iversen 1941).

The experiment devised by Iversen sought to test various questions raised by this theory, predominantly the feasibility of such a clearance given the tools available and the problems of burning the felled timber. The provisional results indicate that clearance of primeval type forest with ground flint axes cannot have involved very appreciable difficulties (Jorgensen I953). However, once the felling and burning element of the experiment had been carried out, parts of the area were sown with Einkorn, emmer and naked barley. The results of this phase of the experiment were not quantified beyond recording that in the unburned areas hardly anything grew due in part to the acidity of the forest soil and on the burned areas a luxuriant crop grew. The second year saw a radical reduction in this crop yield. The final ongoing phase of this experiment is the observation of the regeneration of the flora.

It is in the light of this experiment in Denmark that a similar slash and burn experiment was constructed at the Butser Ancient Farm Research Project in Hampshire (Reynolds 1977). The experiment was designed to investigate the kind of yields that might be expected from this type of clearance agriculture and, thereafter ,to monitor the regeneration of the flora.

As in Denmark, primeval forests no longer exist and this precludes an exact replication of the original conditions. Indeed, in the United Kingdom except for a very few precipitous places where primeval woodland is arguably extant, the lichen evidence from all other forested areas suggests a definite break in continuity (Tansley 1939). Therefore, the only woodland or forest available is of a secondary nature. Given the findings of the Danish experiment there is a major problem of understanding continuity. If in the second season the crop result is minimal, what agricultural policy does the new farmer adopt? His options are fairly limited. He could move the arable plot to another adjacent burned area in the normal traditions of swidden plot rotation (Wolf 1966), or he could re-fertilise the original plot with wood ash from the domestic hearth. The pollen evidence suggests continuity of agriculture over several decades (Iversen 1941). Observation of weed invasion into arable fields suggests at least three years' continuity. In a newly cleared forest area this period should be considerably extended. The latter possibility of re-fertilisation needs yet to be examined empirically, the former swidden system is the one envisaged as the background for the Butser experiment.

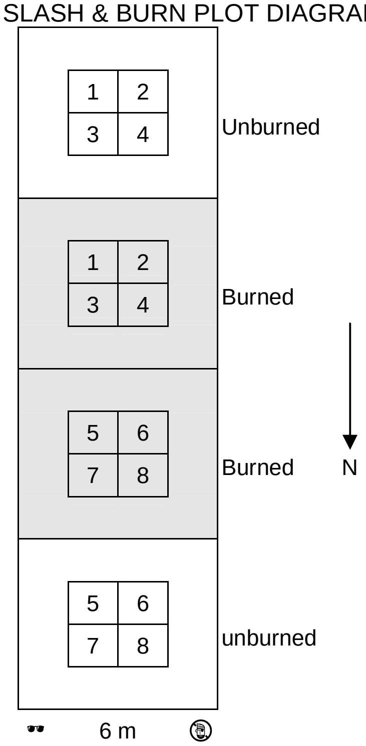
The general area of woodland in which the experiment was mounted is known as Round Copse, located on the north-east slope of Little Butser, the land area of the Butser Ancient Farm (OS Sheet 197, 721209). It consists of typical secondary woodland of the chalklands of southern England (Tansley 1939). The tree cover is primarily ash, hazel and thorn, including both hawthorn and blackthorn, with some yew and oak (*Quercus robur*) present, indeed the kind of cover expected under normal regeneration. The average age of the trees, of which only hawthorn and hazel had to be cut down for the experiment, ranged from twenty-five to thirty-five years with remarkably little variation suggesting a regular coppicing programme primarily for hazel which ceased some time after the Second World War.

The fringes of the woodland and any natural glades within it are dominated by brambles (*Rubus spp*.). The ground flora is that of an ancient woodland consisting mainly of dog's mercury (*Mercuralis perennis*), wild garlic or Ransoms (*Alliumi ursinum*) and bluebells (*Endymion non-scriptus*). That the wood is at least two hundred years old is attested by its being marked on the early estate maps. The presence of a number of earthworks including field lynchets indicates that in the first millennium B.C. the land was open.

The piece of land selected for the cultivation experiment was a narrow strip 6 x 24 m. The cleared area set into the woodland was surrounded on three sides by trees, predominantly ash, with an average height of over 10 m, the open side on the west, 5 m from open grassland, was dominated by a solitary ash tree. The slope along the long axis was even and had a fall of 1 m from south to north. This was divided into four equal plots 6 x 6 m (Fig. 1). Because it was necessary to compare the performance of the cereal crop in burned and unburned ground, the two outer plots were simply cleared of standing vegetation. The central pair of plots was systematically burned. All the timber which had been felled with axes from the whole of the area, trunks, branches and undergrowth, was fired in windrow fashion so that the total area of these two plots was thoroughly burned. Chrome-alumel thermocouples were used to monitor both the temperature of the fire and the temperature reached 0.05 m below the surface of the ground. Although the thermocouples in the fire registered over $900^0$C. before burning out, there was no appreciable rise in temperature immediately below the ground surface. After the firing, the ash was spread evenly over the burned area. Sample weighing of the ash indicated a yield of one pound (0.45 kg) of ash per square metre from the fire. Finally, the whole area was fenced off with fine meshed wire netting, the bottom of which was turned outwards and covered with soil to prevent any intrusion by rabbits. Its gauge, however, was sufficiently large to allow passage by field rodents like the vole. The height of the netting was restricted to 1 m so that it would not be a deterrent to deer. Both roe (*Capreolus capreolus*) and fallow deer (Dama dama) are present in some numbers. The former, along with the red deer (*Cervus elephus*) is regarded as indigenous.

Thereafter, each plot was sown with 1lb. (0.45 kg) of emmer wheat *(Triticum dicoccum*), evenly spread in shallow seed drills some 0.05 m deep drawn with a mattock hoe. The seed drills in the unburned plots required some effort to draw, because of the remanent root stock, while in the burned plot it was quite easy to ensure that the seed was sown in a mixture of ash and soil. After germination, all the plots were hoed twice, once each in April and May. Germination in the unburned plots was consistently lower than in the burned plots because of the persistent competition of dog's mercury (*Mercurialis perennis*). Even after three years of regular working this pattern obtained. The burned areas, however, maintained a high germination until the season of 1976.

FIGURE 1
SLASH & BURN PLOT DIAGRAM




The germinabilitv of the seed was tested annually and gave a consistent return of 98 per cent. The germinability tests consisted of ten replicates of fifty seeds; the results are expressed as an average since the variability of each replicate never exceeded two.

The results of the yields achieved in each season of the cultivation experiment can be seen in Table I. The figures are based upon individual 2 m x 2 m quadrats drawn from each of the 6 m square plots. In any crop yield assessment, it is necessary to dismiss a metre wide perimeter band around the plot because of the more favourable conditions for rooting. Thus each 6 m plot provided only four 2 m x 2 m squares which yielded a crop figure (Table 2 and Fig. 1). It is particularly necessary to observe the total perimeter band around each quadrat since the whole experiment was situated on sloping ground and an overspill effect due to surface water movement could affect the downhill unburned quadrat. The restricted area devoted to the experiment was judged to be adequate in the light of Iversen's findings of considerable disparity in yield performance. The figures, while barely enough for statistical validity, do support this judgement.

Each year the harvest was gathered by hand. Only the spikes or heads of the cereal were collected and weighed. Thereafter, sample quantities of the spikes were broken down, the glumes, palea and lemma being removed and the naked seed weighed. Again, there is little variation to be found in the results, the seed dry weight being 70 per cent of the gross dry weight. Detailed analysis of this seed/total spike weight ratio of emmer and spelt wheat and Einkorn is a major component of the agricultural research at the Ancient Farm (report forthcoming). After the harvest the straw was cut down, bundled into sheaves and removed from the plot. Each spring, the plot was cultivated with mattock hoes to produce a shallow tilth 0.10 m deep. Hoeing was always carried out across the slope to avoid aiding any overspill.

TABLE 1
Summary of yield figures in cwt per acre (Figures in brackets are tonnes per hectare)

| | BURNED PLOTS | | UNBURNED PLOTS | |
|---|---|---|---|---|
| Year | Gross Yield | Actual Yield | Gross Yield | Actual Yield |
| 1973 | 13.0 (1.6) | 10.0 (1.2) | 7.8 (0.9) | 6.0 (0.7) |
| 1974 | 11.7 (1.4) | 9.0 (1.1) | 6.5 (0.8) | 5.0 (0.6) |
| 1975 | 7.8 (0.9) | 6.0 (0.7) | 2.6 (0.3) | 2.0 (0.2) |
| 1976 | Seed | Return | Seed | Return |

Actual yield is the naked seed weight

TABLE 2
Gross yields from each quadrat. Quadrat numbers as in Figure 1.
Figures are in Imperial Pounds. Figures in brackets are in kilogrammes

| | BURNED PLOTS | | | UNBURNED PLOTS | | |
|---|---|---|---|---|---|---|
| Quadrat No. | 1973 | 1974 | 1975 | 1973 | 1974 | 1975 |
| 1 | 1.3 | 1.3 | 0.8 | 0.9 | 0.6 | 0.4 |
| 2 | 1.2 | 1.4 | 0.8 | 1.2 | 0.5 | 0.2 |
| 3 | 1.5 | 1.4 | 0.8 | 0.6 | 0.8 | 0.2 |
| 4 | 1.6 | 1.0 | 1.0 | 0.7 | 0.7 | 0.3 |
| 5 | 1.4 | 1.3 | 1.0 | 1.0 | 0.6 | 0.3 |
| 6 | 1.2 | 1.3 | 0.7 | 0.9 | 0.9 | 0.2 |
| 7 | 1.1 | 1.2 | 0.9 | 10.8 | 0.8 | 0.3 |
| 8 | 1.9 | 1.1 | 0.8 | 0.6 | 0.7 | 0.4 |
| Total | 11.2 (5.08) | 10.0 (4.54) | 6.8 (3.08) | 6.7 (3.04) | 5.6 (2.54) | 2.3 (1.04) |

Yield Returns over Seed Sown
Annual Imput: 4.00 lb (1.8 kg) for total area (144 $m^2$), 1.78 lb (0.81 kg) for yield area (64 $m^2$)
Net output (yield less seed sown)

| Year | 1973 | 1974 | 1975 |
|---|---|---|---|
| Burned Plots | 10.3 (4.7) | 9.1 (4.1) | 5.9 (2.7) |
| Unburned Plots | 5.8 (2.6) | 4.7 (2.1) | 1.4 (0.6) |

The results from the four years of the cultivation phase show a steady decline in yield although it can be argued that the burned plots consistently produced a viable return. The unburned plots, as a control, clearly demonstrate the difference of performance and, without any form of fertiliser beyond the mulch provided through weeding, became uneconomic after two seasons. It is a great pity that the drought of 1976 precluded a standard continuation of the experiment. However, it alone must be adjudged responsible for the 1976 figures. The conditions experienced on the Ancient Farm during the drought were so extreme that even the grass failed. It became necessary to restrict any other than essential access to the farm at all. Nonetheless, the incidence of such extreme conditions, which are surprisingly common, underlines the need for long-term agricultural research in order to achieve valid results. The general evidence suggests that the climate was drier and probably warmer in the neolithic and bronze age periods. Droughts would undoubtedly have occurred with probably similar results. However, the object is to determine an average rather than exceptional model. Given the truncation of this phase, the results still indicate a longer period of viable yield than observed by Iversen. A logical projection of the results suggests a period of four seasons would be reasonable. This experiment set out to evaluate for how long a useful yield could be achieved and it would be unwise at this stage to imply real agricultural practice. It would seem valid, however, to judge a virtual sixfold return an acceptable yield (see Table 2).

The second phase of the experiment is to monitor the regeneration of the natural flora within the plots. The results of the first season's regeneration can be seen in Table 3. This has been presented in three sections detailing respectively plants of woodland, arable land and grassland as observed on Little Butser. The plants of open grassland dominate the regeneration pattern at this stage. It is remarkable that many of the pestilential arable weeds like charlock (*Sinapis arvensis*), hedge mustard (*Sisymbrium officinaIe*) which proved to be the dominant weed of the experimental 'celtic' field systems in 1977 (Reynolds 1977), and poppy (*Papaver rhoeas*) have failed to make any significant appearance on the plots at all. Any colonisation from the experimental field system is unlikely since, while the distance, c.100 m to the south-west, is not great, the prevailing wind is from the north-west. In contrast with Iversen's experience, *plantago* has yet to make its appearance. The only plant observed in the first year of regeneration to be restricted to the burned plots was Aarons Rod (*Verbascum thapsis*).

A few remanent seeds of emmer wheat lost from the previous year's harvest also germinated. These were primarily within the burned plots. The regeneration of the woodland plants, however, is of considerable interest. The rootstock of the burned stumps of hazel and thorn trees has all started to sprout. Only one seedling has been isolated. This could be because the old stumps are still dominating the ecosystem or, alternatively, because of the competition afforded by the arable weeds. Similarly dog rose (*Rosa cf canina*) is also sprouting from rootstock. Tansley 1922 considered that dog rose and bramble would be the first colonisers. In an experiment set up in 1909 by Tansley on West Harting Down in Ditcham Park Estate, Hampshire, an area of grassland was fenced off against rabbits in order to study the regeneration of woodland species. After two surveys carried out in 1914 and 1920, Tansley suggested that after the first colonisers, dog rose and bramble or dog wood (*Cornus sanguinea*) on the bare patches, ash (*Fraxinus excelsior*) would intrude followed after fifty years or so by beech (*Fagus sylvatica*). A similar experiment being carried out by the Nature Conservancy Council on Old Winchester Hill in Hampshire, as yet unpublished, seems to indicate a somewhat faster process suggesting a good woodland cover within fifty years.

However, the slash and burn experiment differs essentially from these experiments in that it included a sequence of burning and cultivation. Nonetheless, it is remarkable, given the proximity of a mature coppice, that there is only one seedling in the first season.

Throughout the experiment the fencing against rabbit intrusion has been maintained. That it proved no obstacle to deer was proven during the season of 1976, since the tender new shootsof the hazel and thorn stumps were seen to be grazed. Whether deer have accounted for any other seedlings is impossible to establish. Certainly the explanations offered here are hardly persuasive.

It is intended to publish annually the species lists of plants and their relative abundance within the experimental plots. These lists will be available on data microfiche obtainable from the Butser Ancient Farm Research Project.

TABLE 3

Plant species list as observed in the slash and burn area in August 1977. The habitat groupings refer specifically to the Butser Hill area. Nomenclature of vascular plants follows Clapham, Tutin and Warburg (1962)

A. PLANTS OF WOODED HABITATS

| BOTANICAL NAME | COMMON NAME |
|---|---|
| Arum maculatum L. | Lords & Ladies |
| Bryonia dioica Jacq | Red or White Briony |
| Corylus avellana L | Hazel (sprouting from root stocks) |
| Crataegus monogyna Jacq | Hawthorn (sprouting from root stock *) |
| Mercurialis perennis | Dog's Mercury |
| Rosa canina | Dog Rose (sprouting from root stock) |
| Rubus fruticosus agg. | Bramble |
| Stachys sylvatica L | Hedge Woundwort |
| Urtica dioica L | Stinging Nettle |
| Viola riviniana/rechenbachiana | Common violet |

- one seedling only

B. PLANTS OF ARABLE FIELDS AND WASTE PLACES

| BOTANICAL NAME | COMMON NAME |
|---|---|
| *Aegopodium podagraria L* | Ground Elder |
| *Capsella burse-pastoris L* | Shepherd's Purse |
| *Galeopsis ladanum L* | Hemp Nettle |
| *Geranium molle L* | Doves-Foot Cranesbill |
| *Rumex crispus L* | Curled Dock |
| *Sinapis arvensis L* | Charlock |
| *Sisymbrium officinal L* | Hedge Mustard |
| *Sonchus arvensis L* | Field Milk Thistle |
| *Stellaria media L* | Common Chickweed |
| *Triticum dicoccum* | Emmer Wheat * |
| *Verbascum thapsis L* | Aaron's Rod |
| *Veronica persica Poir* | Baxbaum's Speedwell |

*15 plants of Emmer Wheat were recorded, 2 in burned plot south, 3 in unburned plot south, 7 in burned plot north, 3 in unburned plot north.

C. PLANTS OF OPEN GRASSLAND

| BOTANICAL NAME | COMMON NAME |
|---|---|
| Cerastium arvense L | Field Mouse-ear Chickweed |
| Cirsium acaulon (L) Scop | Stemless Thistle |
| Cirsium arvense (L) Scop | Creeping Thistle |
| Cirsium vulgare (Savi)Ten | Spear Thistle |
| Crepis Capillaris (L) Wallr | Smooth Hawksbeard |
| Clechome hederacea L | Ground Ivy |
| Holcus lanatus L | Yorkshire Fog |
| Hypericum perforatum L | Common St. John’s Wort |
| Leontodon hispadus L | Rough Hawkbit |
| Lolium perenne L | Perennial Ryegrass |
| Lotus corniculatus L | Birds-foot Trefoil |
| Myosotis arvensis L | Common Forget-me-not |
| Primula veris L | Cowslip |
| Plantago media L | Hoary Plantain |
| Prunella vulgaris L | Self-heal |
| Ranunculus repens L | Creepring Buttercup |
| Senecio jacobaea L | Ragwort |
| Senecia officinalis L | Groundsel |
| Taraxacum officinale Wber sensu lato | Common Dandelion |
| Trifolium dubium Sibth | Lesser Yellow Trefoil |
| Trifolium pratense L | Red Clover |
| Trifolium repens L | White Clover |
| Veronica chamaedrys L | Germander speedwell |

The implications of the natural regeneration process are important in that these direct observations will not only help to elucidate the pollen evidence record as it exists now, but will also focus attention on to areas previously ignored or even unrecognised. For example, one major requirement to facilitate the understanding of pollen data recovered by excavation is the creation of a modern pollen record. By implementing a contemporary pollen trapping programme from a known location, it should be possible to construct valid interpretational models. It is also desirable to assess how far pollen rain from prehistoric cereals like emmer, spelt and Einkorn might spread.

One further aspect to the regeneration studies is the annual monitoring of the quantity of charcoal remaining in the soil. In Table 4, the results of the initial test can be seen. Using random number tables, three samples were taken from the burned areas and three from the unburned areas. The latter results showed no presence of charcoal at this time and are not included in the table. The former results are expressed as a dry weight percentage of the total sample. The purpose of this process is to attempt to provide a standard against which archaeological data might ultimately be measured. There is certainly no distinguishable 'layer' representing intense burning. Indeed, since the firing process took place on the ground surface which was subsequently cultivated and, therefore, thoroughly mixed, a 'burning layer' is unlikely to emerge. Perhaps, in due course, some charcoal will, by worm action, reach the interface of soil and rock and thus provide an indicator. Should it do so, it is likely to be extremely slight thus under-lining the need for extremely precise and detailed excavation and the value of a comparable standard. Subsequent results will be published annually.

TABLE 4

Charcoal fragments remanent in random soil cores from burned plots recovered by flotation

| Sample | Total dry weight (g) | Weight of charcoal (g) | % of total |
|---|---|---|---|
| 1 | 43.88 | 2.21 | 5.0 |
| 2 | 52.7 | 3.71 | 7.0 |
| 3 | 77.97 | 3.45 | 4.4 |

It is only by conducting such experiments, and the one here described must become one of a series, that any practical understanding of the extremely limited evidence of the initial clearing of the landscape can be gained. Once agriculture becomes the basic economy of a culture, however limited in extent that agriculture may be, it is of prime importance to recognise the implications involved. Agriculture indisputably concerns crops and stock, land cultivation and maintenance, fields and fences. Further, all these physical elements must be viewed in the context of practical time. Indeed our understanding of the incidence of agriculture is pitifully small.

The process of accumulating scientific knowledge involves the formulation of rational, logical, deductive theories, the establishment of 'rules of correspondence' between the theories and the real world, and testing whether the observations of the real world confirm or disprove a theory. In the most rigorous sense, no theory can be proven true or validated. It can, however, through proper experimentation be invalidated. A theory can be considered valid only after repeated conduct of experiments which, by their design, appear capable of proving the theory invalid. If such invalidation constantly fails to occur, then the theory may be tentatively accepted as valid (Margenau 1950). Inevitably, with any aspect of prehistoric archaeology we are dealing with approximations. It can well be argued that all knowledge is but approximate to reality. Without more direct investigation of theories by experimentation, and the above experiment is only the second to be conducted into the problems of slash and burn technology in Europe, then the theories can hardly be held to approximate to anything.

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