# The Economics and Management of the Forest Habitat for Pheasants

P. A. LONG and J. WHELAN

Department of Agricultural Zoology and Genetics,
University College, Belfield, Dublin 4.

## INTRODUCTION

Basic ecological requirements for pheasants include the availability of food, roosting sites, cover for shelter and concealment, and the presence of open areas for territorial display (Lachlan and Bray 1976). Since these are rarely supplied by any one vegetation type, pheasant range is a phenomenon of edge effect. The suitability of the forest for pheasants then will depend upon its capability to provide edge. An ideal forest habitat might then be described as a structurally diverse woodland of mixed hardwood and conifer composition which would allow incident radiation reach to the forest floor to encourage growth of shrubs, thickets and herbaceous plants, interspersed with open areas either within or exterior to the forest.

The provision of an optimum habitat for pheasant is most certainly competitive with commercial forestry which is the primary reason for the association of pheasant shooting with less intensive forest management systems. Theoretically 5% of woodland areas is all that need be unproductive of timber to create suitable conditions needed to maintain a breeding stock of pheasants (Gray, Eley Game Advisory Service, 1966). However, part of the remaining 95%, although classed as "productive", may not yield as high a financial return from tree species planted for habitat improvement rather than for productivity. Competition also exists for other limited resources such as labour, machinery and capital input. Problems may also arise in the timing of forest operations such as grass cleaning, thinning and felling which may need to be either delayed or brought forward to accommodate pheasant breeding and shoot management. The incorporation of shoot management in a forest management plan certainly poses many financial pitfalls but it should be stressed that shoot management is also concerned with sound economic practice. To assess the feasibility of integrating pheasant shooting and forestry a number of theoretical management options were tested on a study area where the intensity

of forest management might perhaps allow for the provision of a pheasant shoot for monetary gain.

## THE STUDY AREA

Knockrath Woodlands lie within the Vale of Avonmore in southern Co. Wicklow, approximately midway between the villages of Laragh and Rathdrum (Map Reference S.H. 775665; O.S.S. No. 115-6" 1 mile). They comprise of some 274 ha of mixed high forest of diverse structure. Table 1 shows a classification of the forest area in terms of land use and forest structure.

Table 1: Land use classification for Knockrath Woodlands for 1983. (Student working plan for Knockrath Woodlands, 1983-88).

| Land use | Area | No. of sub-compartments | Average area per subcompartment |
|---|---|---|---|
| Mixed broadleaved high forest | 21.4 | 14 | 1.53 |
| Coniferous high forest | | | |
| (1) Establishment | 22.2 | 7 | 3.2 |
| (2) Thicket | 34.0 | 12 | 2.8 |
| (3) Small Pole | 41.5 | 24 | 1.7 |
| (4) Large Pole | 13.3 | 7 | 1.9 |
| (5) Small Timber | 26.0 | 12 | 2.2 |
| (6) Large Timber | 71.7 | 24 | 3.0 |
| Total | 208.7 | 86 | 2.4 |
| Scrub/unplanted | 18.6 | 6 | 3.1 |
| Pasture | 25.5 | 5 | 5.1 |
| Total | 274.2 | 111 | 2.47 |

The natural climax vegetation found on the predominantly acidic soils occurring in Knockrath (Carey, 1970) was sessile oak which co-exists with beech as dominants in the canopy. Much of this area of broadleaved high forest (BHF) had been allowed to degenerate allowing the development of rich shrub, field and ground layers including, bracken, bramble, and bilberry. The predominant species found in the coniferous high forest (CHF) were Douglas fir, Sitka spruce and the larches.

The scrub is generally found on poorly drained peaty podzols

where cover consists of alder *(Alnus glutinosa)*, birch *(Betula spp.)* and *Juncus* communities. Areas that were as yet unplanted were characterised by strong growth of bracken and bramble. A relatively large area was under pasture which was let for grazing.

## Materials And Methods

### *Managment Options*

There were two fields of action involved in the managerial options that were to be tested on the estate. These were (i) a possible increase in the resident pheasant population by release of pheasant poults and (ii) a possible interference in normal management policy with an intended modification of the forest habitat to improve it for pheasants. Four options were chosen from a 2 x 2 matrix based on a null or positive action. Broadly then the options were:

(1) no release and no interference in forest management;
(2) the release of pheasants with no interference in forest management;
(3) no release of pheasants with modification of the forest habitat, and
(4) the release of pheasants with modification of the forest habitat.

### *Option 1*

This option required no intervention in the normal planning and running of the forest estate. An estimation of the present worth of shooting rights was made on the basis of the overall quality and distribution of ground cover catalogued for each sub-compartment (Long 1983), and on the potential yield of pheasants for the 1983-84 shooting season. The potential yield was extrapolated from a census of breeding cocks taken in late March and early April of 1983, using reproductive indices and juvenile survival rates detailed by Leopold (1961).

The adoption of this course of action would not place any restrictions on the future management of the estate. However, the rewards to be reaped from the sale of shooting rights would not be very great.

### *Option 2*

Option 2 involved the introduction of artificially reared birds into an unaltered forest habitat in order to increase the value of shooting rights. Four strategies were considered for the rearing of 5,000 pheasants, the costs of which are listed in Table 2. The cost of rearing pheasants from the unhatched egg (Strategy I & II) includes all costs inclusive in the subsequent rearing of both day-old chicks and poults (Strategies III & IV respectively).

Table 2: Comparison of the costs of materials for the four suggested rearing strategies.

| Strategy | I | II | III | IV |
|---|---|---|---|---|
| Nature of Cost | Value (IR£, 1983) | | | |
| Incubator and Rearing Equipment | 879.64 | 560.10 | 560.10 | — |
| Eggs/Birds | 372.74 | 1,732.74 | 4,100.00 | 10,500.00 |
| Fuel | 1,633.20 | 1,633.20 | 1,633.20 | — |
| Food | 873.72 | 873.72 | 873.72 | — |
| Miscellaneous Cost | 1,300.00 | 1,300.00 | 1,300.00 | 1,300.00 |
| Labour | 8,320.00 | 8,320.00 | 8,320.00 | 5,720.00 |
| Cost of Release | 3,474.58 | 3,474.58 | 3,474.58 | 3,474.58 |
| Total Cost | 16,853.88 | 17,894.34 | 20,261.60 | 20,994.58 |

I: Incubation of home produced eggs; II: Custom hatching of home produced eggs; III: Purchase of day-olds; IV: Purchase of 6 week-old poults.

The incubation of home produced eggs (Strategy I) has problems inherent in the uneven production of eggs by hens during the laying season. This problem can be overcome by sending eggs to a commercial game farm to be 'custom-hatched' (Strategy II). For a fee the keeper can then obtain regular batches of day-old chicks for rearing. Direct buying of day-old chicks bypasses the costs and time involved in the production of eggs from captured wild stock. Shoots which may not wish to commit themselves to the high cost of capital, food, fuel and labour required in rearing from the day-old stage may prefer to buy six-week old poults. These, like home reared stock, must be conditioned for a time in release pens before being allowed complete liberty in the wild. Their release into permanent pens in the forest encourages birds to remain in the immediate area once they have become free-ranging, providing suitable sites have been selected and birds are fed regularly.

Practically, the most economic method of rearing is the custom-hatching of home produced eggs and the subsequent rearing of day-old chicks to their release at six weeks of age (Long 1983). The poults then released into centralised sub-compartments containing optimal hiding and roosting cover interspersed with sunny areas. The site would be specifically located to limit movement of pheasants out-side the estate as far as possible and to allow adequate control of predation.

*Option 3*

In this an attempt was made to encourage an increase in the present pheasant population by modifying the forest habitat. A number of theoretical management practices which laid emphasis on an increase in ground cover and edge were costed (Table 3). These would provide the required criteria for a suitable pheasant habitat:

(a) Heavy thinning of the upper canopy. BHF would be managed by the selection system in order to provide structural diversity and to ensure a sustained yield. In coniferous crops it was thought to be more practical to remove 80% of the yield class per annum along a ten meter wide external margin to a limit of one hundred stems per hectare.

(b) A delay in canopy closure brought about by an increase in initial planting espacement or a later respacing operation. As well as making thinning operations more economical for the forester the delay would also provide prolonged ground cover.

(c) The replacement of coniferous crops with hardwoods. This would be implemented along some external edges where the topography might make it uneconomic to thin and harvest commercial conifer crops.

Table 3: Breakdown of management practices and affected areas involved in the modification of Knockrath forest for options 3 and 4.

| Management Practice | Area (ha) | |
|---|---|---|
| | Option 3 | Option 4 |
| (a) Heavy thinning of BHF | 8.1 | 6.5 |
| Heavy thinning of CHF | 5.74 | 2.44 |
| (b) Replacement of CHF | 5.23 | 15.0 |
| (c) Planting of *Lonicera* | 4.14 | 1.68 |
| (d) Establishment of coppice | 2.1 | 2.8 |
| Underplanting with Norway spruce | 1.6 | — |
| (e) Widening and formation of rides | 4.57 | 3.55 |

(d) the restriction of grazing under mature coniferous crops to encourage the growth of denser ground cover of bramble and bracken.

(e) The introduction of plant species to the shrub and field layer to improve available ground cover — most especially the shrub honeysuckle *(Lonicera nitida)*. Their introduction would perhaps be most beneficial in those areas where the borders of coniferous plantations had been heavily thinned or where mature coniferous woodland adjacent to open land was lacking in ground cover. Maximum benefit would be derived by positioning plants as flushing points or a holding cover.

(f) The underplanting of hardwood crops with coppice, suitable conifers or the provision of coppice-with-standards. Coppicing ensures a regular succession of habitat for pheasants and also has the added advantage of an open canopy through which it is easier to flush or put up birds when shooting. Coppicing was traditional to Knockrath where oakwoods were so managed for charcoal production. The demand for oak has now declined unless timber is of first quality. The preferred species for a standard would then be ash which demands a high market value for turnery and sports goods. Hazel and sycamore are first class species for coppice — both occur naturally in Knockrath and are readily saleable as firewood for which there is an ever increasing market.

In the case of light demanding tree species such as larch, pine, ash and oak which have thin crowns that don't effectively shade the

ground, yield can be improved by mixing them with shade-bearing species. This gives an opportunity of planting Norway spruce under mature broadleaves lacking in ground cover and later marketing them as Christmas trees.

(g) A decrease in the size of production units and an increase in border area ratios. Structural diversity would be conferred by producing a mosaic of age classes and increase in edge. However, this would be associated with a decrease in economies of scale. Edge effect can also be promoted by the use of well positioned rides to break up uniform blocks of timber. Further improvements can be gained by widening the recommended road formation width to 20m and by planting shrubs along the margins for cover.

(h) The utilisation of scrub areas and 'natural' clearings. It can prove invaluable to retain even the smallest areas of scrub and bramble to fulfil cover requirements for pheasants. Natural clearings left unplanted can increase the importance of the surrounding area by providing open areas surrounded by a shrub border.

*Option 4*

This option required a combination of the two preceding options in which pheasants would be released into a modified forest habitat in order to gain a long-term increase in population density. If the annual release of pheasants is to be successful it would be helpful to zone the forest into areas where shoot management has priority and areas where commercial forestry is of greatest importance. The delineation of shooting blocks would then allow more intensive development of the habitat. Two blocks were chosen in areas consisting largely of pre-thicket crop (Table 4) and were modified as follows (Table 3):

(a) A heaving thinning of the upper canopy of mature BHF and CHF.

(b)The replacement of conifers with hardwoods which, in this case, centred upon the establishment of pheasant coverts. This consisted of a central block of pure hardwoods (ash) surrounded by an exterior margin of conifers. A 20m wide ride ran down the centre leading to a terminal flushing point consisting of pure coppice and low shrubs.

(c) The encouragement of under-storey growth in existing oak woodland,

(d) The introduction of shrubs. Apart from the inclusion of *Lonicera nitida* in pheasant coverts it might also be introduced to some hardwood and larch areas.

Table 4: Structural breadown of Knockrath forest for Option 4.

| Structural Type | Shooting Block I | | Shooting Block II | | Commercial Forest | | Total |
|---|---|---|---|---|---|---|---|
| | Area | % age | Area | % age | Area | % age | 100% |
| Closed canopy CHF | 14.5 | 10 | 10.0 | 6 | 128.0 | 84 | 152.5 |
| Open canopy CHF | 27.8 | 49 | 10.5 | 19 | 17.9 | 32 | 56.2 |
| Mixed BHF | 6.9 | 32 | 3.1 | 15 | 11.4 | 53 | 21.4 |
| Scrub/unplanted | 10.0 | 50 | — | — | 9.9 | 50 | 19.9 |
| Pasture | 4.7 | 19 | 10.3 | 43 | 9.2 | 38 | 24.2 |
| Total | 63.9 | 23 | 33.9 | 12 | 176.4 | 65 | 274.2 |

(e) An improvement in the present system of rides with the aim of breaking up each shooting block into separated drives to improve shooting.

The reared pheasant poults would be released into permanent release pens which should be centrally located in each shooting block. The use of pheasant coverts as pens would be ideal since they would provide mature timber, coppice and shrub cover all serviced by a wide sunny ride.

## The Evaluation of Managerial Costs and Benefits

Economic comparison between the four options is difficult due to the differing nature of various costs (for instance, annual costs are not directly comparable with capital costs). Since capital costs were initial purchase prices they do not occur in the following years. Capital costs were, therefore, converted to annual equivalent values (AEQ) which took account of the cost of borrowed capital which must be repaid over a defined time period. Similarly changes in revenue arising from a change in forest management policy in order to accommodate shoot management had to be accounted for. In this case revenue which accrued over the standard rotation for each tree species was calculated using present timber market prices and then discounted back to the present. This value was then converted to an annual equivalent value per hectare to facilitate comparison between revenue or losses arising from changes in planting regimes, and for addition with other costs and revenues.

In terms of value of shooting rights the four options were grouped by the type of shooting each would provide. Options 1 and 3 would give rough or 'walking' shooting whereas the other two options would yield higher quality driven shooting. Incomes from the sale of shooting rights were based on approximate present market values.

## Results

The costs and benefits accruing from each managerial option are shown in Table 5.

### *Option 1*

Option 1 requires no intervention in the normal running of the forest estate and should have no effect (cost) on forest management. The apparent shortage of pheasants (0.82 birds per hectare) that was present on the estate is reflected in the low value of shooting rights. If shooting rights were to be let in a similar fashion to Forest and Wildlife Service properties a price of 25p per hectare might be obtained.

Table 5: Economic comparison of costs and benefits of the four managerial options tested.

| OPTION | 1 | | 2 | | 3 | | 4 | |
|---|---|---|---|---|---|---|---|---|
| Nature of cost/benefit | Cost | Benefit | Cost | Benefit | Cost | Benefit | Cost | Benefit |
| *Pheasant rearing* | | | 14,419.76 | — | | | 14,424.81 | |
| *Pheasant release* | | | 3,474.58 | | | | 3,474.58 | |
| *Modification of Forest Habitat* | | | | | | | | |
| Heavy thinning of BHF | | | | | — | 340.20 | — | 312.00 |
| Heavy thinning of CHF | | | | | 51.37 | — | 20.15 | — |
| Replacement of CHF | | | | | — | 375.05 | — | — |
| Provision of coverts | | | | | — | — | — | 950.57 |
| Establishment of coppice | | | | | — | 109.56 | — | 175.17 |
| Planting of ground cover | | | | | 74.52 | — | 21.67 | — |
| Underplanting | | | | | — | 555.27 | — | — |
| Road and ride-line improvement | | | | | 55.28 | — | 50.64 | — |
| *Sale of shooting rights* | — | 68.55 | — | 20,000.00 | — | 137.10 | — | 22,000.00 |
| Subtotals | | 68.55 | 17,894.34 | 20,000.00 | 181.57 | 1,517.58 | 17,991.85 | 23,437.74 |
| | | — | | 17,894.34 | | 181.57 | | 17,991.85 |
| Net Benefit | | 68.55 | | 2,105.66 | | 1,336.01 | | 5,445.89 |

*Option 2*

Option 2 will involve some interference in forest management since it requires ground for the rearing and release of birds and a need for co-operation between forest and shooting interests. The costs incurred in the rearing and release of birds would place a financial burden on the estate but this would be recouped by the later sale of shooting rights. The release of pheasants in large numbers inevitably means a driven shoot in which beaters flush birds over standing guns. Since the number of pheasants that will be seen by each gun should be greater, the price of a day's shooting could be high (in the order of £200 per gun). At least ten shooting days could be expected for ten guns which would bring in a total revenue of £20,000 per anum. The returns of shot birds should be around 35% of the released stock and the income gained from selling these should be more than offset wages for beaters and gun dog handlers.

*Option 3*

Option 3 attempts to improve pheasant breeding success by modifying the forest habitat to gain an increase in the number of potential territories. The calculation of the costs involved in these alterations had shown that it was actually more profitable to improve the habitat for pheasant even though there was a net loss of 2.7% in the productive forest area. Unfortunately the habitat is unlikely to be the only limiting factor on population increase. Predation, shooting and inclement weather during the breeding season all take their toll of birds. In consequence, the population is likely to take a long time to grow significantly from such a small initial number of birds. It would seem unrealistic to expect a rise in value of shooting rights above 50p per hectare.

*Option 4*

The increase in benefits derived from changes in forest management in Option 4 over those in Option 3 was a direct consequence of the concentration of shooting interest in two select areas. This meant a decrease in loss of productive forest area to 1.77% and an increase in the area of CHF that would be replaced by pure ash crops (Table 3). The inclusion of the costs of pheasant release gives a net monetary loss. However, by nature of its centralisation and layout this option would provide the better shooting giving an added premium of at least £20 to the price of a day's shooting. The cost of pheasant release should thus be covered by the annual income of £22,000 from the sale of shooting rights.

## DISCUSSION

In comparing the four options it is perhaps more logical to separate them in terms of 'fields of action'. From the point of view of pheasant release, providing the market value of driven shooting maintains a level above the cost of rearing and release, it will always be of more value to release pheasants if planning to let shooting rights.

It is theoretically more profitable to modify the forest habitat to benefit pheasant shooting. This profitability is due to three main features. Firstly, previously unmanaged hardwood crops would now be selectively thinned to promote natural regeneration and thus gain from a formerly untapped source of revenue. Secondly, the establishment of understories (either coppice or Norway spruce) in broadleaf stands would utilise biotic resources that the overstory is unable to exploit giving a greater level of productivity per unit area. The third and greatest source of benefit is associated with the replacement of CHF with hardwoods — either pure ash or coppice — with ash standards in this case. The price per cubic meter for hurley ash plus the additional firewood produced is a far greater reward than can be expected from returns given by any coniferous species. In fact two species (Japanese larch and Scots pine) actually showed a negative return to investment at the 5% discount rate used. The losses that were incurred were from the heavy thinning of CHF borders, the loss of productive land in the provision of wider and increased number of rides, and the cost of planting *Lonicera nitida* as ground cover. The cost of road and ride line improvement can be offset to some extent by the planting of Christmas trees along road margins during the early stages of rotation (Eley Game Advisory Service, 1965).

Option 4 shows the greatest overall return between the four options. It involves the wide scale replacement of CHF with majority ash pheasant coverts and the formation of several new rides. Realistically the forest manager is unable to make wholesale clearance of growing tree crops unless they have reached financial maturity. Instead, the forest manager is far more likely to opt for a strategy such as Option 2 where forest management is largely uninterfered with. In this case birds would need to be released in centralised areas consisting of pre-thicket crops (for cover) and a strategic course of post-release feeding would need to be followed to assure the concentration of birds for shooting.

The enterprising forest manager who is looking for ways of reducing costs involved in the releasing of birds and increasing revenues from forest produce should later think in terms of a change in forest policy. By increasing the number of possible territories

a resident breeding population of pheasants may be seen to increase following restocking (Lachlan and Bray 1976). This would allow a drop in future pheasant release numbers and its associated cost. Leopold (1983) stressed the importance of high interspersions of habitat types to encourage a higher density of territories for birds such as the pheasant. The major factor that determines territorial location appears to be the length of habitat edge where ground cover (shrubs) abuts to open field layers (Lachlan and Bray 1973, Ridley 1983). Where interspersion is high, habitat edge is increased, and the field of vision between neighbouring cocks will be reduced possibly resulting in a higher density of breeding territories (Lachlan and Bray 1976). Modification of the forests habitat would involve the maximisation of edge to increase territory numbers. Initially, this might give a net loss to investment since concentration would be upon road and ride line improvement, heavy thinning of CHF edge and the planting of ground cover. Later modification would include heavy thinning of BHF, underplanting, and most important, the establishment of a managed coppice system. These would counteract the previous measures and yield a positive return.

A change in forest policy need not necessarily be entirely confined to modification of the habitat. In fact one of the major sources of friction between forest and shooting interests can be forest operations and their timing. However some new operational policies have actually aided shoot management (Eley Game Advisory Service, 1966). The move to wider initial planting espacement with commercial conifers can reap benefits for forester and shoot manager alike. For the forester it means savings in the cost of plants, planting and subsequent weeding operations as well as a delay in first thinning which yields more valuable thinnings and shortens the financial rotation for saleable sawlog. For the shoot manager an increase in planting espacement means a delay in canopy closure, thereby, prolonging the period for which new plantations form a suitable habitat for pheasants (Lachlan and Bray 1973). Respacing operations would provide a similar effect.

Normal weeding operations in the forest generally coincide with the pheasant nesting season. This is usually in the period early May to the middle of June when hens that are disturbed may abandon the nest. This is also the main hand weeding season so the switch to chemical weeding has been an improvement for shoot, as well as forest, management. The most effective time for chemical control of weeds (especially grasses) is early in the season before pheasants are far into nesting so disturbance is slight. Spot application of chemical will free the trees from competition whilst leaving

intermittent undergrowth for nesting and shelter (Eley Game Advisory Service, 1966). Two operations that are of benefit to shoot management are the provision of inspection paths and brashing. Inspection paths allow penetration by beaters and assist in predator control. Brashing of semi-mature conifer crops adds ground cover where such cover is likely to be sparse. Cost precludes the cutting of many inspection paths and brashing has now become totally uneconomic since the low pruning of timber adds no monetary value to final wood prices at the present time.

Thinning and felling operations can have disastrous effects on shoot management when carried out near release areas. These operations are a necessity to commercial forestry and unless land has been zoned otherwise, there will be need for co-operative planning. Shoot interest should be warned at least five years in advance of operations so that they may avoid the major disturbances caused by tree felling.

Contractors may cause problems especially since their objective is to make maximum profit from forestry operations. It is often in the interests of both forest and shoot managers to bind contractors to conditions which compel them to consider vested interests in foresty and shooting. Conditions should include specified routes of extraction, time limits for the completion of operations and the removal of lop and top.

In the long term it would be possible to integrate forest and game management even further and to achieve maximum prices for shooting rights. Over a longer time period, such as the rotation, major habitat changes may be made with a view to the centralisation of shooting in specific areas. The definition of commercial forest areas and shooting blocks would allow a clear statement of priorities to be made for each zone. Future rotations in shooting blocks could then be planned to optimise pheasant holding capacity while at the same time improving upon the quality of birds shown to guns.

In conclusion, in areas where the intensity of forest management might allow it, it is theoretically possible to combine shoot and forest managment whilst still making a profit from both enterprises. To be successful close co-operation between the two interests is needed with a view to long term plans in which the forest area would be divided to give a clear statement of priority to either pheasant shooting or commercial forestry.

## REFERENCES

ANON. 1966. Eley Game Advisory Service Booklet No. 15. Forestry and Pheasants.

CAREY, M. L. 1970. A preliminary survey of the soils of Knockrath Woodlands. Unplublished.

LACHLAN, C. and R. P. Bray. 1973. A study of an unmanaged pheasant population at Brownsea Island. Transactions of the 10th Congress of the International Union of Game Biologists: 609-617.

LACHLAN, C. and R. P. BRAY. 1976. Habitat selection by cock pheasants in spring. J. Appl. Ecol. 13: 691-704.

LEOPOLD, A. 1961. Game Management.

LONG, P. 1983. The economics and management of the forest habitat for pheasants. Unpublished undergraduate thesis, U.C.D.

RIDLEY. 1983. The mating system of the pheasant *(Phasianus colchicus)*. Unpublished Ph.D. thesis, University of Oxford.