

# IRISH FORESTRY

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## Imminent Management Problems in Scottish Forestry.\*

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I propose to lead up to my main thesis by making a few elementary observations.

One of our difficulties in British and Irish forestry is the question of nomenclature. So many of our technical terms are translations—often of rather a crude kind—of continental terms, and the term 'management' in forestry is one of these. No one who plants trees or grows trees is likely to be pleased when he is told that his plantations are not properly managed. He will usually take it as a slur upon his organizing ability, business capacity, etc. He may be the type of person who, in the ordinary sense, manages everything well.

The term 'management' in forestry, however, stands for something more than that. It is, I believe, derived from a translation of the French term 'aménagement', which really means a "management plan, properly drawn up, approved, and recorded with the intention that it should be operated".

I suggest, therefore, that the term 'forest management' necessarily implies that we are concerned with much more than the mere running of a forest, namely with the *working* of a managed forest or of managed woodlands, that is, with defined areas of woodland or forest, managed with a true forestry objective.

At this point I must explain what I mean by 'a true forestry objective' because trees can be planted with no such objective in view and the plantations can be run without any true forest management being essential.

We must, I think, draw a very sharp line between the forester proper and the tree-farmer. The objective of the tree-farmer is merely to grow '*crops*' of trees on his ground—usually in any odd corner he has available—with the sole object of felling and selling what he regards as the final 'crop' at some future date—and as he hopes at a profit. He is not interested in the perpetuation of his woodland or forest. He buys what plants or seed he requires at odd times, plants at odd times, thins at odd times and clear-fells at odd times. There is no

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clear relationship between the parts of his forest and hence there is no true 'forest management'.

The forester proper, on the contrary, always has as his main objective a permanent forest, the function of which is to supply a need *in perpetuity*. Broadly speaking, there are two main functions performed by any forest, namely a productive function i.e. the production of some consumable commodity, required by man, or a protective or amenity function. In every case, however, the stand or forest which exists or is created is expected to function effectively in perpetuity. If the main function is a productive one, the main object of management will be to produce the most possible of the best possible in perpetuity. If the main function is that of amenity or protection it will be to keep the forest permanently in the best state of health and never to so treat it that it ceases, even for a decade only, to fulfil its expected function.

In either case, if the forest or woodland is to function satisfactorily, the forester has to arrange for two things—namely, for the perpetual *regeneration* of the forest and for *constant tending* of the forest to ensure that it is either maintained in the state of highest value production or in that healthy state which conserves its protective value or its amenity value.

To simplify my further argument, I propose to confine myself to a consideration of the productive forest only, but it must be stressed that the protective and amenity forest needs to be managed in the forestry sense just as much, if not more than, does the productive forest.

The basis of all sound forestry is sound silviculture. The forest cannot be satisfactorily regenerated nor can it be properly tended to ensure its being kept in good health unless sound silviculture is practised. A first essential in the management of any forest is that the owners should lay down the *silvicultural* objective or the *growing-stock* objective. This may involve a consideration of economic factors, but a perpetual forest can never be realized if the locality factors are not such as to ensure that the type of growing-stock aimed at can exist on the area in a healthy state in perpetuity. Before any real management plan can be drafted it is therefore, vital that the growing-stock composition, the exploitable size and some conception of the time taken to reach that size, should be fixed. Not until then is it possible to arrange for satisfactory management. In fixing the growing-stock objective full consideration must, of course, be given to the problem of regeneration, especially of whether natural or artificial methods are to be applied. The tree-farmer always uses artificial methods, the true forester, only when natural methods fail or *are uncertain*.

Once the forester has been given his growing-stock objective, his management task becomes clear-cut. When the exploitable size has been fixed and when he has, by appropriate mensurational procedure determined the average rate of growth in his forest, he can ascertain the time it will take for trees to reach that size and he then fixes what is

called the 'rotation'. This is, of course, a very important matter, because of its effect upon his main task, the satisfactory regeneration of his forest. If the rotation is too short it may be *impossible* to use methods of natural regeneration and if too long, it may lead to site degradation or loss of production.

Assuming, however, that the rotation length is silviculturally satisfactory, the forester is now in a position to arrange for the perpetual regeneration of his forest. He is working with a perennial enterprise on an area basis. When this enterprise is fully constituted, it consists of a part which is ready for regeneration on which the trees have attained exploitable size. This part, in theory, will amount to the whole area divided by the selected rotation. The rest of the area constitutes the 'sufficient reserve', that is an area of sufficient extent to bear stands all of the same extent as the area to be regenerated to the number of the length of the rotation less one. There must be a full complement of these stands, and, ideally, they should form a graded series so that every age from 1 up to the rotation age less one is represented. I hope that I may be forgiven for stressing what must be an elementary point to everyone here, but I feel I must do so, because this fundamental principle of forest management is so often ignored and the ill effects of ignoring it are so little appreciated.

From the very beginning of every forestry enterprise, whether it be that of creating a new forest or whether it be that of bringing a natural virgin forest into full production, the object of management is to bring about this satisfactorily graded distribution of age-classes, and anything which is done which has the opposite effect is fundamentally unsound. For example, if in any one year an area larger than the area which should be regenerated normally, when the enterprise has been fully established, is planted or regenerated, that is a step away from normality and ultimately leads to difficulties, besides being economically unsound. In the virgin forest, on the other hand, the problem usually is to get rid of ever-mature stands of low production and to replace them by stands of maximum production, but it would be wrong to assume that the best way to do that is to regenerate more than the normal area. As a rule, taking everything into consideration, the best plan always is to regenerate no larger an area than the whole area of the forest divided by the exploitable age.

In effect, therefore, to apply principles of forest management to any forest means *that*, as the first essential step. When this problem of timing has been settled the next thing is to arrange for the best spatial arrangement over the ground of the areas to be regenerated. In this connexion several things may have to be considered, including questions of utilisation and marketing. Silvicultural considerations may require that the areas to be regenerated should be as widely dispersed as possible; economic considerations may require that they should be concentrated as much as possible. In drafting the management plan

some compromise may be effected. For example, it is not unusual to break the rotation up into *periods* for regeneration and to break the area of the forest up into *blocks* for regeneration, each within its period, stands of nearly the same age being grouped together in a block. These blocks may be dispersed by parts throughout the forest, or concentrated in a single place, but in all cases adherence to the fundamental principle of satisfactory age-class gradation is essential. It is true that there are sometimes economic advantages in grouping three or four regeneration areas together for regeneration in one year but that is a process which can be carried too far, with harmful effects.

In some types of forest it is possible for the regeneration to go on over the whole area simultaneously and for the structure of the stand to be such that all the age-classes exist thoroughly intermingled in the stand. Such a stand is difficult to manage. In other types of forest the mixture is less intense and exists in the form of groups of trees having the same age per group. This is less difficult to manage.

With these preliminary remarks I now propose to deal with my main thesis.

Compared with most continental countries, the existence of large forest units in Scotland is a relatively new feature in our forestry. It is true that one or two landowners have in the past owned or created extensive areas of plantations, but, for one reason or another, these have not proved to be permanent. Mainly as a result of two world wars, they have been largely destroyed. Fairly extensive areas of unmanaged forest have survived in parts of the Highlands. A common feature of all these large wooded areas has, unfortunately, been the complete absence of forest management as it is understood in the modern meaning.

In other words, none of these areas has been subjected to a long-term plan of management which would ensure their perpetuation in some form or other, however unsatisfactory. There has been no real effort to establish normality or to ensure sustention of the growing-stock, production and yield. As a result when crises demanded it or opportunity arose, they have been brutally devastated and in many cases extinguished. This is true, not only of former woodlands, but also of the justly famed extensive areas of artificial woodlands created by enterprising landowners in various parts of the country, particularly, so far as Scotland is concerned, in central Perthshire, Peebles-shire, Strathspey, Deeside and around the Moray Firth.

Further, with regard to the smaller woodland areas, these have usually been established for secondary objects, such as shelter, game-coverts and so on, and few, if any, have been made the subject of a permanent management plan with commercial forestry as the aim. Even to-day, under the Dedication Scheme, the short-term plan of operations cannot be regarded as a satisfactory substitute for a proper long-term

plan intended to maintain the wooded state and production in perpetuity.

While we may justly claim to be expert *afforesters*, we have never made any serious attempt to *manage* properly the so-called forests which we have created. It can truthfully be said that we have as yet no properly managed forest in Scotland, i.e., with a properly graded series of sizeclasses from the seedling up to the exploitable tree, satisfactorily arranged over the ground in one way or another in such a way as to enable a constant yield to be obtained from the forest every year—a yield not in excess of the production, but approximately equal to the production when that has been brought to a maximum. It is therefore of very great importance that this problem of the future management of the large artificial forests now being created should have immediate consideration. We should be looking ahead and testing out various procedures which will ensure that the forests of the future are properly managed and not merely completely blotted out again in some future crisis. We can learn a good deal from what has happened and been done on the continent. It is my purpose in this talk to try to define the nature of the problem, which is now urgent, and to suggest what steps might be taken to make future forest management, not only easier, but possible.

When the Department of Lands acquired an area of over 3,000 acres of mature woodlands at Cong, it was the first occasion on which I was brought up against the problem of management and I was not at all clear how to proceed. I have learnt a good deal since.

#### *The Nature and Origin of the Problem.*

The nature of the problem can best be understood if we now restate the essential features of a well-constituted forest.

1. The forest should be such that it fulfils the functions expected of it in the most satisfactory manner. There should be no sacrifice of exploitability.

2. The forest should be one adapted to the locality and the site so that it can be maintained there in sound health in perpetuity.

3. The economic objective and the growing-stock objective best fitted to enable the economic objective to be realized should be determined and clearly laid down.

4. When the economic objective is one of providing produce, i.e. a productive one, the growing-stock should be so constituted and distributed over the forest *that* an annual yield can be removed equal to, but not exceeding, the annual production, when the latter has been raised to a maximum.

5. To enable this to be done, all parts of the forest should be equally accessible so that the most mature trees can always be removed

as well as those inferior trees which are not mature but have to be removed in the interests of the better trees, from any part of the forest.

6. The growing-stock should be so constituted that there is always a succession of classes decreasing in age, which can follow on to replace the most mature class, normally removable or exploitable. It is the need for this sequence of age-classes, conveniently distributed and located, which makes forestry unique as an enterprise.

7. To enable the succession of age-classes to function properly they must be present in the forest in satisfactory proportions.

8. There must be a satisfactory outlet or market for all the produce provided by the trees that are exploitable.

If all these eight conditions are satisfactorily fulfilled, the formation of a plan of management is relatively easy and the forest will be able to contribute to human welfare in the most efficient manner. It will be in a position to furnish a constant supply of raw material for human use and will be a source of constant employment. Moreover, if the forest is not too extensive and widely scattered, the labour force can be concentrated at convenient centres and will not have to travel long distances to operational points or fluctuate in numbers from time to time. *Permanent* communities can then become established consisting not only of forest workers but also of a population employed in wood-using industries which do not have to range far for their raw material.

#### *Size of the Forest-unit.*

Before we ask in what respect many of Scotland's newly created 'forests' fall short of the above requirements, we may give some thought to the question of size of unit. In many cases, especially in respect of private woodlands, the size of the forest is prescribed by the area of land available for forestry. The *minimum* size depends first upon the main economic objective. A shelter-belt, for example, may be as small as two acres and still be perfectly effective. The minimum size for a productive woodland, i.e. one which will yield something of value every year depends very much upon the locality conditions and the species grown. It is, for example, quite possible to run small coppice areas on short rotations to give an annual yield in perpetuity fairly easily. Quite arbitrarily, I am going to suggest that the smallest *high-forest* area that can be run to give an annual yield in perpetuity is one of 50 acres, which must be on fairly productive ground with at least average rate of growth.

The question of the *maximum* area for convenience of management is equally important. Remembering that large forests often have to be broken up into two or more working-circles, and that these in turn, if large enough, have to be once again broken up into two or more working-sections or series, I am going to suggest that a convenient

*maximum* area for a series or working section is one of 1,800 acres. In most cases one of 1,200 or 1,500 acres will be more convenient. If the forest is an even-aged one this will give an annual coupe of at least 10 acres if the maximum rotation is 120 years or 150 years. There are many reasons for not having coupes much larger than that in any forest.

It is important to observe, moreover, that if the forest-unit is less than some 300 acres in extent, it becomes very inconvenient, if not impossible, to run it by the clear-felling or shelterwood systems. Some form of irregular treatment has to be adopted, either group selection or stem-by-stem selection, *if the maximum annual yield in perpetuity is to be realized*. A coupe of less than 5 acres is seldom worth while annually and it is usual to work the forest intermittently by periodic fellings rather than annual fellings. For example, a felling of 25 acres every five years instead of one of 5 acres annually, but this procedure has its obvious inconveniences—especially in respect of sustaining employment.

There should be a plan of operations for each working section or series, especially in hilly country or where the terrain is much broken so that means of access are restricted to a limited number of routes, e.g. along valleys.

Now let us see in what respects are Scotland's newly created forests defective. The first point that strikes one is that many of them are too large to be worked as one management unit. They require to be divided up into smaller units, not exceeding 1,800 acres each. This would not, I think, apply to any of your Irish forests.

Another point that strikes one is that all the forests and all parts of them have as their only function the productive one. It is true that small areas are now being treated as fulfilling secondary functions such as the provision of amenity and recreation, but no parts of forests have as yet been regarded as protective, yet it is quite certain that in all hilly areas where planting has been carried far up the slopes, a zone of protective forest, requiring special treatment and management will be necessary. These areas should be set aside *now* as separate units.

There can be no doubt that large areas of the new forests are not adapted to the locality and site, but this is a silvicultural problem in the main which will solve itself as time goes on and experience is gained. I shall show how advantage can be taken of this position from a *management* point-of-view.

I believe I am right in saying that seldom, if ever, is the economic objective and the growing-stock objective specifically laid down when a new forest is being created. All that can be said is that a genuine attempt is made to grow the species thought to be best suited to the site, but usually preference is given to fast-growing species. That can lead to great management difficulties, however desirable it may be economically or politically. Slow-growing species which can remain healthy and stable for long periods have important management advantages, especially when they suit the site.

With regard to the need for uniform accessibility to all parts of the forest, there have been great improvements in this respect in recent years, although often at heavy cost. It is well known that many of the first plantations, established on a large scale by the State, received no consideration so far as means of future access was concerned. There are still extensive high-lying, remote parts of some forests which manifestly cannot be made so accessible as the remainder. Either access to these should be improved or they should be set aside as parts of a separate working-circle or section from the main area, and put under a separate plan.

The most serious defect, however, is that the principle of sustention has in all forests been deliberately neglected. No attempt has been made to space out the afforestation programme so as to secure the essential gradation of age-classes in each forest. For political reasons the planting up of large units within the space of only a few years has been undertaken. While it is true that this was the most rapid means of obtaining the reserve of grown trees softwood timber which it has been the main policy of the State service to ensure, it inevitably leads to great management difficulties and is the negation of sound forestry. It would have been very much better to constitute units for management purposes of on the average 1,800 acres each, fixed a rotation—better called an establishment period—divided that into 1,800 acres and planted the number of acres arrived at annually in that unit and no more. For example, if the establishment period were put at 60 years then 30 acres a year would have been planted in each 1,800 acre unit and no more. In due course, all the other operational activities would have followed on the same modest scale until the 60th year, at which time a consideration of what the exploitable size and age might be would fall due. Subsequent management procedure would depend on the decision then **made**.

While there are certain disadvantages in this procedure—they are mostly short-term ones and, in my opinion, far outweighed by the long-term management advantages.

This rational afforestation procedure would furnish the succession of age-classes in satisfactory proportions which is essential for sound management. Instead, most forests present the spectacle of a small range of age-classes excessively represented. I am aware that some foresters see a possible solution to this difficulty in regarding whole regions or even the whole country as one management unit and they think that the age-class gradation will be fully represented even if it happens to be scattered far and wide. This represents a scatter of employment and of production which cannot be satisfactory and may involve movements of population and of enterprises on a larger scale than that occasioned by the recent storm-damage in the north-east of Scotland.

Lastly, we can be sure that there will be a market for all the produce



provided by the exploitable trees? This is indeed a difficult question concerning which we foresters must have faith. I think, however, that more than faith is needed. One way to meet this difficulty is to conform to the old adage—don't put all your eggs in one basket. We should grow a variety of trees which is not merely economically sound but silviculturally sound, so long as we grow them on the sites suited to them. In particular we should not grow too much of one class of produce, especially if it is of an inferior quality. Nor should we grow too much of those species which grow rapidly in youth but cannot be kept standing for long periods without deteriorating. However slow-growing they may be, Scots pine and oak are long-lived. Other useful species in that respect are European larch, beech and sycamore on suitable sites.

#### *Suggested Remedies.*

While I have already hinted at some remedies to some of the troubles, there are several major steps which require special consideration with a view to remedying some of the major defects. Improvement of accessibility to all parts of every forest-unit is one obvious remedy. Our predecessors were often well aware of the importance of this and many private woodlands are admirably served with roadways.

There remain two very important major steps to be taken and which demand immediate action, namely:—rational sub-division of forests into smaller management and working units, and establishment of a more satisfactory gradation of age-classes within these smaller units. I propose to consider these two steps in turn.

#### *Fragmentation of Management-units.*

The primary sub-division of any forest-unit should be on the basis of the functions performed by the unit. Areas utilized for production should be separated from those utilized for protection or for amenity or any other secondary function. It is quite a normal thing, for example, on private estates to reserve a part of the woodland for amenity purposes and to dedicate the rest for production—the two areas being managed under separate plans. This procedure should also be adopted in all forests where areas have to be classed as protection forest. In hilly regions there will normally be a high-lying exposed zone of forest which cannot be worked by regular silvicultural systems, but will have to be run by some form of selection working. It should thus be one of the first steps in the introduction of proper management to determine the boundary and extent of all such protective zones in terrain where they are necessary. These zones will constitute a separate working circle and may have to be divided up into two or more series. There is no minimum area which can be worked in this way; consequently the

demarcation and segregation of this area will leave over an area of forest which can be worked by any desired silvicultural system or systems, if it is large enough for more than one working-section. If this left-over area is less than 300 acres there would be very strong reasons for adopting some method of uneven-aged working, for reasons already given.

The next basis of sub-division of the forest-unit would be on the basis of the silvicultural system to be adopted. It might be desirable for example, to work one part of the forest on the clear-felling system and another under the shelterwood system.

The third basis of fragmentation of the forest would be on the basis of size. If any area of the forest suitable for working under one system only exceeded 1,800 acres, then it would be very desirable that it should be broken up into two or more management units, preferably not less than 1,200 acres in extent. Each of these would have to be organized as a separate management-unit, under its own plan. The main bases of the sub-division would be on *topography*, next on the location of markets and next on the location of labour, but in some cases the basis might be one of rate of growth and production.

#### *Establishing a More Satisfactory Age-class Gradation.*

Having broken up the forest areas as just suggested, it is quite certain that owing to the manner of their creation, most of them will be found to consist of a few large blocks, each of one age-class. The problem thus arises how to set about remedying this unfortunate position and it is a problem which calls for very drastic and bold action.

The first point to consider is the probable exploitable size attainable and to be aimed at. There are various aids which enable some estimate to be made. It obviously depends mainly upon the species grown and upon the locality factors. Once determined, the time taken to reach that size can be worked out, giving the 'rotation' for even-aged working. This may vary from say 60 years to 120 years.

The next point to consider is the *youngest age* at which the species composing the forest become exploitable, i.e. so useful that they can be clear-felled at some profit, however small. This will vary with the same conditions as before from 20 to say 50 years.

This second age indicates the age which the oldest plantation in the forest must attain before any conversion into a graded forest begins.

The difference between that age and the exploitable age or rotation length then gives the length of time required to complete the conversion up to the time when further fellings will no longer result in loss of exploitability.

The area to be felled and replanted each year—granted that the forest displays uniform productivity throughout—is the total area of

the series divided by the rotation length. If this area is multiplied by the difference between the initial exploitable age and the final exploitable age it will give an area equal to a fraction of the forest only. The remainder of the forest will consist of stands that are all of the final exploitable age. Their felling and removal will not be completed at the age however but will cover a period of time equal to the initial exploitable age and the last coupe to be cut will thus be older than the rotation by the initial exploitable age.

This can be made clear by taking a concrete case. Suppose for the sake of simplicity that the forest unit to start with consists of one age-class only of say Sitka spruce. Suppose that it is decided that the final exploitable age is 60 years; suppose that it is considered that the stand can be clear-felled at 30 years and sold for chip-board or pit-props. The initial exploitable age is then 30 years and the final one 60 years and the difference is 30 years. In the first year of conversion, if the area of the forest is 1,800 acres, 30 acres of 30 year old stand are cut; in the second and succeeding years again 30 acres. At the end of 30 years half the forest or 900 acres will have been converted. The other half will be 60 years old. It will take another 30 years to convert the other half and the last coupe to be cut will be  $30 + 30 + 30$  years old or  $30 + 60$  years old or 90 years old.

Let us take another example; this time 1,800 acres of Scots pine, the final exploitable age of which is fixed at 120 years and the initial exploitable age at 40 years—for pit-props. As soon as the stand is 40 years old the first coupe of 15 acres is felled and replanted. For  $120 - 40 = 80$  years, each year 15 acres are so dealt with, at the end of which period  $80 \times 15 = 1,200$  acres will have been converted, leaving 600 acres to be dealt with in the last 40 years. The age of the last coupe in this case will be  $40 + 120 = 160$  years. When it has been converted the forest will then contain a complete gradation of age-classes from 1 to 120 years, as required.

Where the individual coupes are to be located will depend upon circumstances. Very very seldom, indeed will it be possible, even if it were desirable, to have a rigid chessboard arrangement. The more sensible procedure will be to deal first of all with the more unsatisfactory stands of more rapid growth. Areas of obviously *slower growth* should be left to fall due for felling near the end of the rotation. Areas of good ground planted with unsatisfactory, possibly fast-growing species, will obviously be chosen as soon as possible for treatment.

Normally in Scotland, therefore, the coupes will be scattered throughout the forest irregularly and the coupe for any given year may even be broken up into two or more separate parts. This constitutes an approach to the procedure which has to be adopted in converting a forest-unit for selection working, which I now propose to touch upon.

*Procedure for Uneven-aged Forest.*

Where for any reason the aim is to work the forest-unit by some system of selection working, a rather less drastic procedure is required.

In this case, especially if there are many gaps and small unsatisfactory spots in the stands, the conversion can be begun without serious economic loss even before the trees are exploitable.

The first step in this case is to examine the rate of growth with a view to deciding upon a suitable length of *cycle of operations*. If the conditions are such that the rate of growth requires intervention at short intervals, say every five years, then the length of cycle will be 5 years. More often, however, it will be longer, up to 8 years. Once the cycle has been fixed the whole of the forest-unit is then divided up into as many equal sized blocks as there are years in the cycle. These should be lettered from A to E or H and each year one block is visited and all cultural operations required therein are carried out. The other blocks are not touched, unless, perhaps, every half-cycle, to carry out urgent thinning and tending. In the current block or block of the year, a certain proportion of its area requires to be regenerated. This proportion depends upon the time estimated for the trees to reach final exploitable size. If, for example, that is fixed at 100 years, then for the whole forest each year a hundredth of its area must be regenerated, all within one block. If the cycle is one of five years, then the area of the block is a fifth of the forest and one twentieth of the block must be regenerated. Single trees or groups of trees must be felled to give that area for regeneration within the block, and this will be repeated every five years. Hence at the end of the 100 years, each block will have been visited 20 times and should contain trees or groups of trees varying in age by five-yearly intervals from 5 years to 100 years.

Size and number of groups vary, but area per annum must not exceed one acre.

Some of these groups will still be in the weeding stage, some in the cleaning and most in the thinning stage, while a few will be ready for final felling, but the forest should be fully stocked with a normal stocking and gradation of size-classes.

The size of the initial groups can be varied to suit the species grown. For light-demanders the gaps must be larger and, of course, fewer,—their total area always remaining constant. There are obvious risks in this way of working but there are also many important advantages. One essential is a complete and satisfactory net-work of extraction roads, so that removal of material is rendered easy. I have not time to deal with the silvicultural aspect of this form of working.

*Conclusion.*

In this talk I have therefore drawn your attention to what seem to me to be extremely important management problems and I have suggested some possible solutions which call for very bold and rather

drastic action. Unless some such steps are taken now however, it seems to me that the future of many forests recently created and now being created will be seriously jeopardized. Some sacrifices must be made in order to introduce that conformity with the principle of sustention which an all-too-hasty afforestation policy has ignored.

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