A PILOT TEST OF MULTIPLE USE
ON A SMALL MOUNTAIN WATERSHED

by
John D. Hewlett and James H. Patric

SUMMARY

A 350 acre watershed at Coweeta Hydrologic Laboratory is being developed to demonstrate multiple use forest management in the southern Appalachians. This report discusses the multiple use concept, forest access as the prime consideration, and plans to manage the area for water, timber, game, and recreation. Multiple use is defined as obtaining a variety of products and services from a group of resources. Resource management is predicated on complete and permanent access to all parts of the watershed. Several uses of wild land are proposed without loss of any single forest use and without reduction in total return from all uses. Some details of land management and road construction are included.

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Timber stands in the southern Appalachians were long ago highgraded, leaving much hardwood forest land occupied by a nonproductive mixture of brush, snags, cull species, and old wolf trees. Only the best sites, usually the coves, have a good timber potential, and even these often are acutely overstocked or crowded by weed species. To date, we have few tested measures for restoring these mountain lands to full timber productivity. Unpredictable markets, difficult topography, ill-defined management units and objectives, and the uncertain silviculture of the great variety of species combine to make timber management in the southern Appalachians one of forestry's more challenging problems.

Recently, added demands are being made of the mountains, formerly regarded solely as timber-producing land. Even as the present demand for wood products increases, pressures mount for water supply, hunting, fishing, and other recreational use in a manner largely unanticipated and unregulated. The principle of multiple use must truly set the course of forest management if we are to anticipate and meet adequately all demands to be made of our mountain wild lands.

Multiple use as a policy is usually defined as a program for obtaining a variety of products and services from a group of resources. It is considered a desirable objective on the assumption that the sum of all resource uses on an area is greater than the value of a single use. There are, of course, people who do not, or will not, recognize this objective. Controversy over the ordering and integration of uses tends to obscure the value of the multiple use concept as a guide to public land management.
Often this confusion has stimulated single use interests to seek advantage while creating haphazard public opinion sometimes unfair and damaging to the multiple use concept.

It is our present thesis that water is the key resource against which to measure success or failure in any attempt to balance and regulate total use of these well-watered mountains. Not only should compartments be based on watershed boundaries but practices designed to increase or harvest any other resource should be evaluated in terms of effects on quantity and quality of the water supply. It is inconceivable that any practice damaging to the water supply can fail in the long run to damage the total productivity of the watershed.

Accepting this thesis as valid, we are attempting to set up a model of multiple use management in the southern Appalachians. At least part of the difficulty in visualizing multiple use stems from lack of good concrete examples of land being managed to provide several goods and services. This demonstration will provide a small working model of multiple forest use as it might apply to private as well as public watersheds 25 or 50 years from now. Particular attention has been given to the interests of municipal and industrial watershed managers, whose problems focus most sharply on the water resource. However, all potential users of the forest have been considered in this model effort to maximize and stabilize all water, timber, wildlife, and recreational assets. There is no intent by means of this demonstration to fix policy or set broad standards for managing similar land units. Rather, the attempt is to balance several uses of forest land without loss of any use and without reduction in total return from all uses. Since sustained yield of water, timber, game, and recreation is desired, time limits on this demonstration are flexible. Nevertheless, we believe that increased productivity of all resources should be apparent in 5 years.

Figure 1. Forest compartments, Watershed 28

Last fall, with funds made available by the Public Works Accelerated Program, a series of forest improvement practices was begun on a 350-acre mountain watershed at Coweeta Hydrologic Laboratory. Watershed 28 (the demonstration area) is representative of much of the southern Appalachians. Although very steep and rocky in places, the most accessible parts were high-graded for logs, acid-bark, and ties from 1900 to 1925. Records show that the original stand was predominantly chestnut, a species subsequently killed out by the blight. Furthermore, these slopes were burned regularly by early settlers to clear the understory for open-range grazing. Composition and form of the present stands on watershed 28 clearly reflect recovery from these events of the past 75 years.

On the moist, deep soils in the cove (132 acres), a fast growing stand of yellow-poplar has developed among the older, larger remnants of the original forest (figure 1). This stand has a high per-
An haphazard public or private effort to harvest any other supply. It is inconceivable that the total productivity stems from lack of interest in the water resource. This demonstrates as well as the means of this demonstration area is one of the most water-productive places in eastern North America (figure 2). Rainfall on watershed 28 averages 90 inches per year, based on 20 years of record from 11 gages. The combination of heavy rainfall and steep slopes has resulted in a dense network of streams. There are 6 1/2 miles of streams on this watershed, of which 1/2 mile carries native brook trout. Mean annual streamflow from the demonstration area is adequate, with total storage, to supply the water needs of a modern community of 1,000 people.

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Watershed 28 carries a variety of game species in addition to trout. Deer, squirrel, wild...
turkey, and ruffed grouse are heavily hunted during open seasons. Other species present are raccoon, bobcat, rabbit, mink, and fox.

At present the entire upper rim of the watershed gets considerable recreational use. Immediately to the west lies the Standing Indian Wildlife Management Area, drawing a yearly influx of hunters from all over the southeast. The Appalachian Trail also follows the ridgetop, while weekend hikers and picnickers are common during all seasons. Because of its past inaccessibility, few fishermen ever visit the lower part of the watershed.

Access is undoubtedly the key to multiple use management. After all, if you can't get people in or products out, little management is possible. And, regardless of which resource we are concerned with, its management usually entails some treatment of the forest cover. All such work involves large volumes of vegetation, requiring a means for moving in crews and heavy equipment, taking out wood and other products. Most measures of forest protection also demand ready access on the ground. Barring logging and access by helicopter, a comprehensive network of roads seems to be the only practical answer.

In the past forest roads usually were built merely to extract existing merchantable timber without regard for adequacy to service other forest uses, present or foreseeable. Such planning resulted in poorly laid-out roads designed for specific short-term purposes rather than long-term multiple use. Almost any topographic map of steep terrain shows a relative coincidence of roads to streams, a pattern demonstrating that expediency has influenced most forest road location. This pattern is hydrologically undesirable, with high flows often diverted down the roads or with the roads serving as a continuing source of sediment to the streams. All too often, the result in mountain areas is washed-out logging roads and heavily silted, unstable stream channels.

Adequately planned access requires not only consideration of existing forest resources but topography, road construction standards, and the foreseeable needs of the future as well. Our major concern was to reduce the perverse influence of topography on construction and especially on maintenance costs. To insure an adequate system the following criteria were considered when planning roads into the demonstration area:

1. Plan access into large units of land, for instance, a whole mountain ridge. We have assumed that the Ball Creek Road, already developed as a forest highway, forms the basic climbing access into the mountain ridge of which watershed 28 is a part.
2. Plan access to serve all foreseeable forest uses and protection needs, cost to be amortized by as many uses as feasible over the first 80-year cutting cycle.
3. Design the access system around a series of road and trail classifications which provide for maximum access at timber harvest but with minimum future maintenance.
4. Design for regulated road use by timber operators and the public, particularly during periods of heavy use or in adverse weather.

Figure 3. Road and topographic map, Watershed 28

PERMANENT AREA ACCESS
SINGLE LANE, LIGHT DUTY CLIMBING
SINGLE LANE, LIGHT DUTY CONTOUR
TEMPORARY CONTOUR
APPALACHIAN TRAIL
TURN AROUND

CONTOUR INTERVAL, 100 FEET
SCALE
0 500 1000 FEET

Table 1
stratification area. Initially follow a direction of maximum access be needed and approxi- mately. This area has been extensively used. Access to wild lands areas

General streams. As they are used, the forest officer's responsibility is to maintain

Initial
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<table>
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<th>Table 1: Types of roads used in road construction and maintenance on the demonstration area</th>
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<tr>
<td><strong>Purpose</strong></td>
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<tr>
<td>Initial cost of this road system will be high but accessibility is expected to be near optimum</td>
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</table>

General, cable skidding will be specified, making limited need for horse or tractor skid trails. As they become necessary, such temporary roads will be planned and approved jointly by a Forest Officer and timber operators. Restriction of these skid trails to specific locations will hold them to a minimum but insure complete timber harvest.
and maintenance cost low. Road use by the public and by loggers will be supervised at all times and postponed when damage to the roads exceeds the value of immediate use. Roads will be closed whenever misuse or overuse by any means threatens to cause undue maintenance. Informative signs will be relied on to help secure public cooperation.

The roads were located last October, holding within grade limits, by use of the Abney level while moving up or down slope to avoid rock outcrops or to cross streams advantageously. Contour roads were to be spaced about 600 feet apart, the maximum distance logs could effectively be hauled to loading areas. Crews cleared rights-of-way 12 feet on either side of the marked road center lines, piling brush and slash along the downhill edge. During November D-6 bulldozers pushed stumps and logs to the downhill edge of the rights-of-way, then cut the road, piling fill on bare soil, using brush and slash piles to stabilize the toe slopes. Cuts were left near vertical but will settle to 1:1 or flatter. Large streams were bridged using nearby trees when possible. Smaller streams were crossed with metal culverts, these ordinarily more quickly and easily installed though more expensive than wood or stone culverts. All streams were crossed at right angles to minimize soil disturbance near flowing water. When feasible, the road surface was elevated well above the streams at the ends of each crossing; eliminating all chance of high flows following down roads. Lastly, shoulders and fills were fertilized, limed, and seeded to grass. Traffic will not be allowed on roads until they can settle and timber harvest can begin.

![Diagram of a broad based dip](image)

*Based upon Coweeta and other experiments.*

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Clear cutting</th>
<th>Understory removal</th>
<th>Thinning</th>
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<tbody>
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Table 2.

<table>
<thead>
<tr>
<th>Initial water yield</th>
<th>To be restored to so</th>
<th>10- to 15-year tim</th>
<th>other possibilities</th>
<th>clear cuttings when pure brush stands</th>
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These demonstration areas are rapid in the Cove the 50-year site has been slower. The such oak-hickory method to regenerate in basal area is also present.

During November and December other crews clear cut most of the lower ridges, a treatment designed primarily to increase water yield. Research at Coweeta and other places shows that most cutting practices increase water yield and that first year increases are roughly proportional to the percentage of basal area cut. Increased water yields are expected about as shown in table 2; results will be verified by standard regression comparison of the treated versus a control watershed.
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Table 2. — Estimated initial water yield increases from all treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Compartment</th>
<th>Area: treated</th>
<th>Watershed Increase per acre treated*</th>
<th>Water Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear cutting</td>
<td>Lower ridges</td>
<td>145</td>
<td>41%</td>
<td>15 inches</td>
</tr>
<tr>
<td>Understory removal</td>
<td>Cove</td>
<td>132</td>
<td>38%</td>
<td>1 inch</td>
</tr>
<tr>
<td>Thinning</td>
<td>Cove</td>
<td>132</td>
<td>38%</td>
<td>6 inches</td>
</tr>
</tbody>
</table>

Total for watershed: 8.9 inches

* Based upon Coweeta research results.

Figure 5. Growth comparisons, plots on Watershed 28.

Initial water yield increases will diminish as stands recover from these first cuttings but can be restored to some extent by further cutting. Most of the followup cutting will be in the cove where a 10- to 15-year timber harvest should maintain water yields well above pretreatment levels. There are other possibilities for maintaining high water yields, including thinnings on the clear-cut area, repeated clear cuttings where reproduction is of low quality, recutting the cove understory, and conversion to pure brush stands on the high ridges.

These same cutting treatments are also the recommended timber management methods for the demonstration area, a choice further dictated by growth records. Figure 5 shows that growth is most rapid in the cove where high quality yellow-poplar is still young enough to respond to management. Here, the 50-year site index for yellow-poplar is 100 feet, well above average. On the lower ridges growth has been slower on stems of poor quality. There has been much discussion as to methods of upgrading such oak-hickory stands in the southern Appalachians; recent opinion regards clear cutting as the best method to regenerate stands of acceptable quality. On upper ridges there has been virtually no increase in basal area during the past 20 years. Here the timber potential is so low that no cutting is planned at present.
The cove will be managed for yellow-poplar on an 80-year rotation. This year all overmature trees will be cut or deadened and the yellow-poplar stand thinned to about 75 percent of the present basal area. Removal of the often-dense rhododendron understory also should spur growth of crop trees. We now envision two or more partial harvest cuts at 10-to 15-year intervals followed by a clear cutting at age 80 years to reproduce a new stand of pure yellow-poplar.

Some TSI work will be done as the better clear-cut stands regrow to merchantable size. White pine may be planted on lower ridges now covered with pure mountain laurel, to provide a cover age 80 years to reproduce a new stand of pure yellow-poplar.

The various cutting practices will serve to some extent as game management measures by increasing browse and providing openings for food-bearing understory species. Seeding roads to grass and legumes will extend and enrich the wildlife food supply. Frequent small log dams are being built in the main stream to improve the trout habitat by creating pools. Old logs, slash, and other debris have been removed from main stream channels, primarily to prevent plugging during stormflows, but also to make them more approachable for fishing. Heavy stands of underbrush will remain for 50 feet along either side of the principal tributary streams to provide a protected source of native trout. These measures are designed primarily to suggest what is possible; policing or other controls are beyond our means and we cannot evaluate their impact on wildlife populations.

Most of our recreational developments are aimed at making the demonstration area attractive to family users. Dyed-in-the-wool outdoorsmen need little inducement to appreciate good hunting or fishing, wherever it exists. These recreational developments are apparently the only ones which could seriously conflict with other resource management, such as water production and fire protection. We particularly wish to avoid large-scale recreation in high quality water producing areas. Road gates and signs will be relied on to hold these casual but numerous visitors along the upper edge of the watershed, well clear of streams and high value timber. Here, a picnic area, vistas, and an attractive trail to the fire tower should provide ample opportunity for a pleasant day outdoors.

The resource management just outlined is, of course, expensive. Of all the commodities with which we are dealing, at present only timber has an assignable dollar value. While returns from all commodities produced can help offset the cost of this demonstration, timber harvest must pay most of the bills. Fortunately, as already mentioned, we are operating on an 80-year time payment plan. A major difference between our time payment plan and that offered by a local department store is that our purchase won't be worn out when paid for. On the contrary, well managed, it should be in better condition by the year 2042 than when bought in 1962.

This demonstration is sure to provoke discussion regarding aptness of the principles which guided our development of multiple use forest management; it is, in fact, a major objective to incite such discussion. We cannot comment constructively on the practicability of this demonstration. It is for the future to decide whether or not such intensive management of public land is practical. Some people may even be disturbed by so intensive a development of wild land resources. There is, we believe, no acceptable alternative to multiple use management; the challenge facing us is the intelligent choice of alternative patterns for developing forest resources within the multiple use framework.

AN AERIAL CAMERA POD TO REDUCE PHOTOGRAMMETRY COSTS

by William A. Shain

Aerial photographs are commonly used in many ways and to various degrees by most foresters in applying forest management practices. The intensity of aerial photographic usage is seldom great except in a few organizations where extensive landholdings enable aerial photographs to present a logical supplement to better forestry. To be fully effective in all phases of forest management, aerial photographs must be taken within one growing season of the date used, in the proper season, with a film and filter combination that can be used to best fulfill the forest management objectives, and at a desired scale (1:16, 840 or larger). In the past these conditions have seldom been met. The cost of obtaining such photographs has been excessive, and it is difficult to obtain contract photographs at exactly the desired time due to previous commitments of the contract agency, to weather conditions, to the impracticability of obtaining photographs of small areas (20,000 acres or smaller), and to the distance of most contract farms from the area to be photographed.

Most of these limitations can be overcome if the organization needing photographs takes its own photos. Weather conditions are always a problem, but they are less important when a company can fly its own flight mission on one day's notice. In most areas, appropriate planes can be rented and pilots are generally available when needed. Areas less than 50,000 acres can easily be flown in one-half day. By renting a plane from the nearest airport, distance to the flight area is not great.