

REVEGETATION FOR AESTHETICS¹

Bernard M. Slick²

Abstract.--Surface mining is changing the landscape character of forests in the East. Aesthetic visual aspects of the landscape are considered in the analysis, planning, and design of revegetation strategies. Application of landscape architectural design techniques in the revegetation of surface-mined lands, as well as knowledge of biological characteristics, will enhance the visual character of the mined landscape.

INTRODUCTION

From the time the first colonists arrived in the East, natural processes (soil and climate, fire, and insects) and man (axes, plows, and bulldozers) have shaped the land, forest vegetation, and openings into patterns which today lend variety to the landscape. These events have varied in location, time, and intensity but most of the landscape has been impacted by man at one time or another. Alterations in the visual character of the landscape in the decades ahead will be a result of man's continuing use, management and mismanagement of the land.

The landscape has taken on meaning because of the variety and composition of patterns that exist. Landscapes rich in variety are likely to have more visual appeal and aesthetic value than ones tending toward monotony. In recent years man's activities have had a profound effect on the face of our forested landscapes. More and more land has been visibly affected. The American people have become increasingly aware of and concerned about the aesthetic quality of their environment. Among these concerns has been the visual effects of surface mining which are often immediate and noticeable from a distance. Often these effects weigh heavily

in the rejection or appreciation and acceptance of a project by the public. Because of these concerns recent national policies and legislative actions have legitimately recognized formal consideration of aesthetics along with other environmental values in planning and decision-making.

LANDSCAPE CHARACTER

Aesthetics involves all of the senses--sound, smell, touch, taste, sight, and movement. However, it is most often equated in a visual sense to denote quality and attractiveness associated with the appearance or visual appeal of the landscape being viewed.

Regardless of the size or segment of the landscape being viewed, it has an identifiable character. The landscape character is described in terms of land and rock forms, vegetative patterns, water forms, and structures as seen by an observer in terms of four basic elements--form, line, color, and texture. These are components of the visual resource that when seen in varying combinations can be used to evaluate aesthetics or visual quality of an area. In providing resources for the Nation's economy, we often have no choice but to create alterations from the surrounding landscape. Acceptable alteration is based upon the degree of change, measured in terms of visual contrast, allowed in the form, line, color, and texture of the characteristic landscape.

¹Paper presented at the "Trees for Reclamation in the Eastern U.S." symposium, Lexington, Kentucky. October 27-29, 1980.

²Landscape Architect, USDA-Forest Service, Northeastern Forest Experiment Station, 204 Center Street, Berea, Kentucky 40403.

An examination of the landscape character of the coal regions of the eastern United States reveals one of their most valuable resources is the scenic quality of their rural landscape in each of the physiographic regions. The attractiveness is derived from a variety of features with the integral scenic element being the vegetative cover and patterns that give character to the visual resource. Cropland and grassland are the dominating vegetation of the Interior regions while the Appalachian region is dominated by mixed hardwoods in the north and pine-hardwood forests in the south. There is considerable range in vegetative types in both deciduous and coniferous species. Understories include a wide variety of shrubs, forbs, and grasses. There are seasonal color contrasts which greatly contribute to the interest. Each of these regions is relatively well defined not only in terms of terrain and vegetation patterns but also in terms of visual characteristics.

More than one-third of the total of the East and South is forested. It has been estimated 90 percent of the surface mining has been or is being conducted on forested areas where 65-85 percent of the landscape is steep. The removal of vegetation during mining and its reestablishment during reclamation creates significant changes in the visual patterns of the cover types and open spaces. This is especially noticeable when there is a continuous forest cover.

Private lands provide 94 percent of the total timber in the East and accommodate intensive recreational and wildlife use and development. However, much of this forest land is poorly managed and stocked with trees of poor quality due to earlier "highgrading" or removal of quality trees. Many opportunities will be available to improve plant community characteristics that will provide recreation, wildlife potential, and landscape character through pre-planning of reclamation on those lands subjected to surface and underground mining impacts.

PLANNING PROCESS

Evaluation of the visual resource involves inventory, analysis, and determination of objectives or standards, and incorporates all of these (together with other resource information) into the resource planning process. It should also include post-evaluation of planning and project accomplishments concerning the visual resource.

VISUAL INVENTORY

"When needed" to support conditions at the pre-mine planning stage, a visual inventory is utilized to identify, classify, evaluate, and map the visual resource according to variety classes and distance zones and to delineate physical landscape quality in relation to user concern or preference. This baseline information is used for:

1. Identifying the existing visual condition of the landscape at a given time.
2. Judging landscape quality.
3. Determining the ability of the land to absorb change.
4. Predicting the visual impacts and consequences of a proposed project.
5. Determining the need for modification of proposals.
6. Monitoring the effects of the applied reclamation treatment over time.

In addition the data can be very useful in identifying areas aesthetically unsuitable for mining and existing reclaimed areas in need of rehabilitation and/or enhancement. Also, it may be used for gaining support of proposals to change prior land uses to alternative post mining uses which may contribute more to improving landscapes than retaining pre-mining use.

Vegetative data needed by the reclamationist generally will be satisfactory for visual analysis. This includes such factors as existing on and off site species of trees, age and size of trees, mixture of different species, even aged or uneven aged stands, productivity, cover density, ground cover, understory condition, layering, shrub and tree ratio, diversity of stands, and openings, and prior use. Additional consideration must be given to native versus introduced species, threatened and endangered plants, animals supported by the vegetation, yearly and seasonal variability, exposure of stands, wind-firmness, insect and disease condition, potential for revegetation, and other relevant information of the area.

VISUAL ANALYSIS

The level of the analysis should be commensurate with the level of visual resource sensitivity and the magnitude of proposed impacts. The analysis must be sufficient to

ensure a reclamation scheme that best satisfies the environment, postmining, local, and regional land use objectives, or area development plans.

The area used to study the landscape and the visual impacts of activity alteration is called a viewshed. It is the total landscape seen or potentially seen from all or a logical part of scenic areas, travel corridors, use areas, and water bodies which are frequented by and readily visible to large numbers of users and visitors.

In predicting and monitoring the visual effects of mining in the viewshed it is desirable to establish an appropriate number of on and off site view points, either moving or non-moving, with typical views of activity. These points are documented on a map with lines drawn to the activity from those views which are deemed important to area residents and potentially obvious to visitors to the region. It is the views from the critical points (often locations from which activity is most seen) which will identify potential for visual concern. Project location, observer position, and distance zones are recognition factors which will help to determine what the aesthetic pictorial or visual effect of changes in the landscape will be from the view points due to viewer location and position, area and angle of view, length of view, number of viewers, duration of view, times seen, and focal point sensitivity. Observations are supported by topographic maps, sketches, photos, and computer printouts.

Location

This is a very important factor because there are really few places in the landscape where excessive vegetative clearing can go unnoticed. Mining, because of the area disturbed, results in a focus of attention. Location is critical because of varying capabilities of the land to withstand modification and varying degrees of visual sensitivity for each area. Some parts of the landscape will be recognized as being more sensitive to impacts than others. Changes on steeper upland slopes are more conspicuous than on flatter ground. The higher the deposit location on a slope or ridge, the more extensive the view points and greater the distance from which mine activity can be seen.

Topographic orientation can be associated with different visual effects. South-facing slopes usually have greater visibility than those facing north because they receive more direct and greater amounts of sunlight. Patterns in vegetation vary due to elevation and orientation. Conifer hardwood patterns in

particular are traced to orientation contrasts.

Many primary transportation corridors follow old mine haul road locations. Often they pass by or through the center of the mining district with many aspects of mining in the viewshed visible to highway travelers.

Distance Zones

These are divisions of a particular landscape being viewed. They are used to describe the part of a landscape that is being inventoried or evaluated from key viewing points. These varying zones of distance are concerned more with the horizontal relationship of the observer to the activity and are classified and quantified in distances at which details can be seen as:

foreground (0 - 1/2 mile)
middleground (1/2 - 3-5 miles)
background (3-5 miles - infinity)

One or more of these visual zones may be readily perceived in most landscapes.

Distance zones establish a distinctive relationship between the viewer and the seen landscape. An activity or scene may be viewed from any one of a number of distances. As these distances differ the observers impression of the visual contrast will vary as perception decreases with increasing distance. For example, the size and shape of a reclaimed area appears larger to an observer who is relatively close to it and smaller when they are some distance away.

Observer Position

This is the elevation of the observer relative to the activity being viewed in the landscape. It focuses on the vertical relationship between observer and activity.

Slope angle and its aspect relative to the observer position affects the visibility of the slope and the development or activities that take place upon the slope. This range of positions is classified as:

1. Observer below (inferior)
2. Observer level (normal)
3. Observer above (superior)

View position influences perception. The apparent size of mine disturbance is directly related to the angle between the viewer's line of sight and the slope being

viewed. As this angle nears 90° the situation reaches its maximum contrast and becomes more critical. A change in apparent size and/or shape also occurs when disturbance is viewed from different horizontal angles and the observer remains at the same elevation.

LANDSCAPE DESIGN

The existing visual elements--form, line, color, and texture of vegetation and landforms provide the basis for designing the visual aspects of reclamation. The degree to which these elements are altered by an activity are measured in terms of visual contrast with the characteristic landscape as to qualities of size, scale, amount, intensity, direction, pattern, etc.

The following guidelines, while by no means complete, are intended to provide direction for measuring the visual resource change that will be introduced by the activity and the anticipated viewer response to that change. They may be applied not only in sensitive areas or unusual circumstances, but routinely in all activities, and by all disciplines.

Contrast

When we view the visual resource as we move from one position to another we realize that there is an apparent harmony and unity of the natural features. When man manipulates the features he alters the elements and produces many artificial characteristics which modify the landscape character in acceptable or unacceptable degrees of contrast.

Contrast is the result of differences rather than similarities between adjacent parts. Activities that create no visual contrast are simply not noticed. Those that create extensive contrast, such as abrupt edges, unnatural form, and vegetative patterns, can be picked out instantly even by the most inexperienced observer. In most cases we want to reduce contrasts but there are cases where purposeful creation of sharp contrasts (such as the addition of flowering plant material) can be beneficial.

Visual quality is often reduced the more an activity contrasts with or visually dominates the landscape. Therefore, the more an activity repeats or borrows from the basic elements (form, line, color, and texture) the less visual contrast and the more it becomes visually pleasant. Landscapes with unacceptable contrast can usually be designed to achieve visually acceptable variety.

It is possible that the quality of surrounding landscape is so low or lacking in variety that almost any activity would improve visual quality and relieve monotony by providing variety and visually acceptable contrast. Conversely, surroundings could be of high quality and an activity could be very destructive to visual quality.

Form

Vegetative form is expressed in the shape of individual, groups, or masses of plantings and clearings. Differences in height, depth, and width promote changes in shape and size or silhouette which create contrast. Light shades and shadows accent form.

Shape--

The shape of an opening created by surface mine clearing is one of the most important aspects in the visual landscape. If the shape of the opening can be related to the surrounding landscape so that it appears natural, a minimal contrast will be the end product. In some areas there may be an absence of natural openings to simulate. The problem then of making a clearing appear natural is very difficult. It can be overcome though, by repeating the directional emphasis of patterns in the landscape forms from ridgelines and drainages.

Shape of vegetative patterns, especially those large and geometric or unnatural in form, can dominate a landscape. Irregular and free-form shapes expose less area to view, soften the visual contrast between plantings and openings, and simulate natural conditions or traditional forms of land use in the vicinity. Strategically located islands, clumps, groups, or fingers of vegetation help to alter the shape and apparent size of openings.

Where a large area is to be disturbed in a series of clearings over a period of years the effect must be considered not only from the first clearing but from the distribution of subsequent ones. The cumulative effect is important.

Scale--

Scale refers to the relative size of clearings or openings in relation to the surrounding landscape being viewed. For aesthetic improvement, size of openings or plantings should be varied according to the viewing distance. The scale of many mining

activities is expressed in undertakings of colossal size even in the expansiveness of their surroundings. All are on a scale totally divided from our varied and intimately humanized landscape. There is no doubt that large acreages of disturbance attract attention and have the properties of being aesthetic misfits.

Scale is a vital factor in the absorption of surface mine clearings into the view of the landscape. When the size or amount of clearing is extensive it may quickly adversely change the landscape character beyond acceptable limits. Because of their size, clearings are visible from great distances, are obvious through all seasons of the year, and show up under practically all atmospheric conditions.

Proper size is dependent upon the nature, quality, and character of the surrounding landscape. Small scale projects may stand out due to their form, line, color, and texture. When the width of a clearing is no more than several times the height of the surrounding trees the space itself becomes sharply delineated in an alley-like enclosure. The wider the opening the less enclosure and the greater the feeling of space.

Large elements require a sufficient amount of space to permit retention of naturalness. As soon as the proportion of man-made form is great enough to challenge nature's supremacy the spell of natural surroundings is broken.

Ground form--

The basic form of topography (mountains, plains, hills) is repeated in the form (conical, horizontal, rounding) of native plants. The effects of reclaimed mine landforms can be modified by plantings. Plants can be used to accentuate or to mask surface changes. Pointed planting masses accentuate; rounded masses blend and merge. Plantings can cause a slope to merge with a plane such as a bench and may be used to visually increase or decrease height of a slope.

Line

Lines distinguishing vegetative forms may be continuous or isolated objects or points along the surface which are connected by our eyes to form a linear path of vision. Lines may be represented by the silhouette of a tree, the edge of a meadow, a forested ridgeline, contour, or a tree trunk. All lines have direction - horizontal, vertical, or oblique. Contrast results from lines of

differing character or direction. The forms of contour mine clearings often have a linear configuration with lines that may lead the observer's eye toward focal points of interest or draw attention to incongruous elements.

Edge--

Edges where dissimilar features come together are especially conspicuous to change. Attention is directed to the maximum contrasts. For instance, skyline--the silhouette where sky meets forest or land; waterline--where water meets the forest or land; and vegetative edge--where grass and forest meet, or where conifer meets hardwood.

Skyline edge--Frequently mine clearings are prominently displayed against or near the skyline. The darker color of the terrain is in sharp contrast to the lighter color of the sky and clouds. Ridgeline junctures can be skyline but are usually viewed against other surface backgrounds.

Vegetative edge--Changes in vegetational types often create abrupt visual contrast due to differences in soil or vegetation color. For example, in Appalachia many contour surface mines are located in forests. Reclamation with herbaceous material creates an abrupt sharp boundary line or edge between the stark openings and the surrounding wall of dense undisturbed woods which stops eye movement and draws attention. This unnatural strong line configuration can be modified by planting shrubs and small trees to undulate or feather the edge between the grass opening and the forest. The edge of the woods should be maintained as an irregular line and generally follow the contour.

Thinning of edges exposed as a result of clearing is important in some sensitive situations. Unprotected exposed edges have greater potential for wind damage and visually have a "raw" impenetrable wall-like appearance.

Selective removal of vegetation back 50 to 100 feet or so from new edge reduces the impact of wind by filtering movement and disrupting its force, reduces the abrupt edge, and extends the boundaries of the perceived space. Existing ground and shrub vegetation should be retained as it provides a gradual slope or drift transition in size from grass to trees and is essential for erosion control. Visually the result after a period of time will allow a more natural appearing healthy forest edge which will also benefit wildlife.

During clearing operations new edges should be upgraded by removing weak rooted, dead, broken, leaning, hung, or visually unattractive trees and cutting and distributing slash (if not removed) close to the ground.

Waterline edge--This edge is a very dominant focal point due to the flatness of the surface of the water which is seen as a definite line against the land. Plantings which border the shores or banks of lakes, ponds, or streams should bear much the same relation to the water surface that tree plantings surrounding an opening might have to a grass surface.

Planting irregular masses to the water's edge produces harmony between planting and water and masks the harsh shoreline edge. Also, shoreline plantings are mirrored in form by their reflection on the water. Plantings near water can provide an interesting and natural diversity of view especially for areas which are subject to public use.

Color and Lighting

Color and lighting enable us to distinguish between objects of identical form, line, color, and texture. They can also be used to subdue man-made and natural objects.

Color contrasts are expressed as hue or chroma (red, blue) intensity or brilliance (purity of color) and as value (light, dark). Contrasts may vary significantly with the time of day, weather, distance, and season of the year. In order to use color successfully it must be studied under local atmospheric conditions. Consideration must be given to how it will be seen from crucial view points.

Color and lighting contrast is often the most noticeable result of surface mine operations as adjacent contrasting colors and shadows stop the eye. The removal of plant material and exposure of the surface establishes a significant contrast with darker adjoining undisturbed vegetation.

Texture

Texture results generally from the pattern created upon the terrain by vegetation and other surface elements. Texture ranges from fine or smooth to coarse or rough. Smooth and dull surfaces affect light reflection and absorption. The perception of texture and patterns varies with observer position and distance zones. Contrasts between textures result from smooth elements against coarse and light and dark differences in color tone. The more variety there is in

the landscape the easier it is to design for texture.

Variety

Variety is an assortment of different parts of the landscape. "Richness" or diversity both carry the same concept. However, quantity of varied parts is no assurance of quality. Landscapes ranking high in visual value are usually those of above average variety.

Landscapes rich in variety are desirable. Vegetation can enhance an area where little variety now exists. For example, species can be introduced to provide spring color, highlight fall color, and to create contrast in form, foliage growth habit, and size. Openings can add variety to a forested landscape that otherwise might be a monotonous cover of trees. The same can be said for the addition of trees to large openings.

Ordinary or minimal variety landscapes with simple and uniform texture of vegetation are weak landscapes. There is little variation in species or vegetative patterns and openings into which changes can be incorporated. The very fine vegetative texture of Appalachian hardwoods explains in part why vegetative clearing for mining is so visible.

In any ecological system, a diverse assortment of plant material is a positive attribute. It enhances aesthetics, provides a diversity of habitat, reflects stability, and promotes resistance to adverse conditions such as disease, drought, and fire.

Vistas and Views

A view is an unobstructed sight of a specified landscape (panorama). This definition differs significantly from a vista which may be defined as an enframed sight of a specified landscape. In this sense a vista has greater visual impact as well as more intense focus on a given landscape.

Vistas and views are desirable where worthwhile opportunities exist. Individuals or groups of trees such as conifers and flowering trees are used to accentuate, focus, enframe, and give scale and dimension to outstanding vistas of physical features such as rock outcrops, lakes, streams, ponds, and falls. Unobstructed openings are retained or vegetation is removed to provide panoramic views in the landscape.

Structures

The impacts of vegetative cover and patterns during mining and reclamation operations usually are greatest in foregrounds and mid-grounds most often visible from public roads near or adjoining mining property. Intensive planning and management practices are needed most in these visual zones of a viewshed to control the composition, quality, and growth for visual impacts and without adding unreasonable costs to reclamation.

Time

Time or duration of visual impact of mining is long-term when compared to other activities that alter the land. Although one of the goals of reclamation is to reduce adverse visual impacts, the visual contrast between reclaimed areas and surrounding undisturbed areas can remain for several years. However, recent emphasis in concurrent reclamation will go a long way in reducing and limiting the amount of area disturbed at any one time. This will provide for an early use and for woodlands being on their way to maturity by the time extraction operations have been completed.

VEGETATION PLAN

Much emphasis is placed on prompt use of herbaceous vegetative cover and its ability to control runoff and erosion but it alone will not always make a site visually compatible. However, little is known about the influence of other vegetation or the ability of the most effective revegetation methods and species in relation to visual quality objectives. In addition to successfully stabilizing a disturbed area, vegetation can have varying visual effects depending on the species selected. Guidelines for maximizing vegetative characteristics to improve the visual condition that are compatible with cover establishment and erosion control are essential.

Because of better placement of overburden, segregation of acid and toxic spoils, use of topsoil or acceptable growth medium and soil amendments, the quick establishment of a vegetative cover in mine reclamation is less of a problem. However, the long term effect and stability needs continuous evaluation especially as an aid to land use, desirable plant succession, wildlife benefits, and aesthetics. With better planting conditions more emphasis is needed on improving plant material selection. Repeated use of plant species such as black locust, lespedeza, and autumn olive are making them as common and as monotonous as the over-used and banned multiflora rose.

Revegetation treatments and aesthetic design must be responsive to land use objectives and an evaluation of the characteristic landscape. The design should be based upon and respond directly and specifically to both visual and functional needs. Revegetation for aesthetics is concerned with reestablishment of the visual landscape character by integrating the post-mining land use(s) of the reclaimed area with surroundings. Vegetation should be planned to facilitate the customary potential land uses of range, fish and wildlife habitat, recreation, forest, crop and pasture lands, residential, industrial, and commercial. Having established the post-mining land use and with the detailed description and design plan for reclamation indicating how the total site will be utilized, vegetative treatments can be developed.

The choice of planting schemes for aesthetic enhancement of surface mined lands is based on the objectives of the person or agency responsible for the planting. The options available and the success of a program depend on the planner's and designer's ability to recognize the opportunities and limitations of each site.

Planting design is a complex task. Considerable study is required to achieve the maximum functional and aesthetic effect. There is no precise formula or procedure for devising a vegetation plan which will effectively encompass all the land use potentials of a reclaimed site. The possible solutions are as many as there are land use types. However, one thing in common to all is that they involve a transition in land use from the original landscape. If the site exhibits vegetative features similar to those inherent in the proposed land use it will be easier to plan and correlate reclamation and land use.

Planning for revegetation requires the ability to envision the maturity of the planting scheme years ahead. The desired character or effect does not exist when plantings are first established but are realized only with the passage of time. Many years are often required to cultivate and develop a stand of trees to alter the appearance of the landscape. Designers often will not be around to observe the outcome of their vision.

To assure a high quality landscape, especially in highly sensitive areas, surface mine reclamation personnel should consider the following plant materials criteria in developing a vegetation plan.

Selection

Several factors may influence the selection of plant species for a given job. These include an analysis of the predominant regional vegetation, land use objective, functional considerations, planting arrangements, future maintenance, and ecological factors associated with climate, season, geographic location, species, and individual site conditions.

In selecting plants, consideration must be given to their ability to adapt to the climatic and edaphic factors which influence the plant's ability to survive and grow. Aesthetic reasons for selection are associated with the growth habits of plant material with due consideration given to size (height, width) form (columnar, pyramidal shapes) and character (texture, dense or open, coarse or fine) needed to achieve desired visual effect.

Rate of growth is important where early results require maximum effect from the initial planting. Growth rates vary considerably, especially for trees. Care should be exercised in selection, as many rapidly growing plants are usually brittle and short lived. Perhaps a well-conceived mixture of fast and slower growing species is best.

Although sometimes less important than the habit and rate of growth, the effects of foliage, fruit, bark, color, and texture nevertheless can add a significant finished effect to individual plants or groups of plants. This is particularly important with deciduous plants which change dramatically with seasons.

A wide range or mixture of vegetation should be used to avoid a monoculture effect. Likewise native species or those that have visual similarity to species in surrounding unmined areas can be used to minimize form, line, color, and texture contrasts.

Plant species selected should generally have been proven successful in the area over the years. However, experimentation with other species or new varieties is encouraged. Avoid exotics or extensive plantings of untried species. New introductions must have a tolerance for surface mine environment and should have sufficient similarities to the existing vegetation in the area to assure that the distinctive character and sense of local identity are not lost.

Aesthetically desirable species do not necessarily mean desirable timber. They may include unmerchantable trees such as ironwood or beech and trees that are twisted or low

branched with a picturesque quality. Many colorful shrubs and small trees have special value for wildlife food and cover.

Function

In meeting reclamation and post mining land use vegetation objectives plant materials are used to serve definite functions or to solve specific problems. In addition to providing a permanent stabilizing cover for controlling erosion, plant materials of varying height and configuration are used to separate areas, screen unpleasant views, give privacy or enclosure, enhance desirable features and structures, and enframe views. Plants are often used to protect adjacent land values, control site circulation, buffer hazardous areas, control glare, reduce scale, augment sparse or inadequate cover, and provide wildlife shelter. Stands of trees create micro climates that are of great importance to residential and recreational developments by acting as windbreaks, filtering dust and noise, and providing shade for various activities.

Arrangement

The proposed location and arrangement of plants selected to achieve planned objectives are shown in a general way on the vegetation plan. The desired visual effect will depend upon how well the proposed composition and patterns of openings in forested lands or plantings of trees, shrubs, croplands, or other vegetation in open non-forested lands relate to the natural patterns of surrounding existing vegetation.

Vegetation is normally not seen as individual plants. What is seen are masses, forms, textures, silhouettes. The contrast of large masses and voids, openness and enclosure, or an irregular flowing mass of shapes are constantly changing as the observer moves around. It is a diversity of forest types and vegetative cover, maximizing forest edge through optimum relationship between forest cover and forest openings. Planting masses should be expressive of the land use function yet not convey an artificial physical appearance. Some plantings will be permanent forests of extensive size, others will be alternated with grassland openings located so as to accent attractive vistas and some will serve as screen.

The composition of the planting varies in two principal ways, pure planting of a single species and mixed plantings of two or more species. Single species plantings are usually easier to establish, manage, and

harvest but they are more susceptible to fire, insects, disease, wind, and other natural damage. An example are the decadent stands of black locust that have been disfigured by borers and leave miners. When and where possible these should be underplanted with more desirable species. Pure plantings are usually associated with a single species such as pine. Trees are normally planted on a grid or row system with little variation in spacing. If pine mixtures are desired, small groups or rows or blocks with variable spacing of plantings are recommended.

Based on past and present experience and observation mixtures offer the best patterns and better possibilities for regeneration. Mixtures provide visual variety and wildlife diversity, accommodate variations in topography orientation and soil moisture, promote stability, and ensure against risk of loss that may be encountered in pure stands.

Each type of mixture has particular application for certain conditions which should be identified and considered in planning an area. If a planting goal is to establish a forest stand with variety, mixed plantings of five or more species should be used. With few exceptions deciduous plantings should be mixed.

Shrub plantings usually are made in block or clump plantings of a single species. If more than one species is used they are placed in drifts (shorter plants in front or on edge) to avoid overtopping due to differences in growth.

Patterns of mixtures which may be used in planting or seeding an area are random, single row, and multiple row mixtures. For visual harmony rows should run parallel with the contours, rather than at right angles.

Spacing--

Openings and plantings that are uniform and regimented in size, shape, and spacing seldom are visually pleasing and lead to monotony and lack of unity in the landscape. Dispersal and irregular spacing can be used to minimize contrast.

CONCLUSION

Regardless of how successful revegetation for a post-mining land use may be in terms of erosion control and good soil cover, the area should also be developed with consideration of its success in exhibiting appropriate visual quality. By applying the preceding principles, processes can be de-

veloped by which the positive visual attributes of reclamation can be enjoyed while minimizing the negative visual aspects of surface mining.

The criteria are new in approach with regard to mined land revegetation and can help provide analysis of the landscape only as they are researched and tested through application. The purpose in discussing these criteria now is to seek their recognition by those who will be working with landscape architects in integrating reclamation and landscape quality.

There is more to revegetation for aesthetics than mere cosmetic beautification. The key to a better end product is coordinated design based upon research and a clear understanding of the interrelationship of all variables of the revegetation activity.

Aesthetics or landscape quality is a shared responsibility often mandated by law. It is a concern that must be shared by everyone and the quest for improvement must be the job of all of us. We need to establish genuine understanding and conscientious cooperation between regulatory authorities, operators, and public in managing and protecting landscape quality. We all must learn to recognize aesthetic values and incorporate and apply criteria and principles routinely in our everyday work and activities. As a result the land will be developed and managed with due consideration of its landscape qualities.

Success with aesthetics will depend mainly upon the sensitive application of fundamental principles by operators who have recognized and accepted the benefits to be derived from implementation of this concept.

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