

# Ecological Highways

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## Abstract

This paper presents a model for planning, development, construction and roadside management which looks at both the floral and faunal aspects of the highway for designation of the appropriate highways as Ecological Highways. This designation would be similar to the existing Scenic Highway designation but concentrates on the natural resource values associated with the highways. The designation would only be used in areas where adjacent land management was directed toward natural resources management for wildlife. These would be areas with large public land holdings unless agreements for long-term management of private lands could be arranged. The designation would require a management plan similar to those developed for Scenic Highways. The management plan would include features of management and structure that would be needed along the corridor in order to qualify for the designation. The principles supported by this concept would include early planning, management of flora and fauna in a manner similar to that of adjacent natural habitat, habitat connectivity for wildlife movement, the use of native species and letting natural processes dictate management in all but a clear recovery zone. The purpose would be to provide the responsible transportation agency with guidance on how to manage a given area to support the natural values of the area while accommodating safety for both the motorists and wildlife of the area. Attention would be given to the micro and macro-scale aspects of the relationships of the highway roadside to the larger adjacent environments in the development of a management plan. The management plan would identify the highway, length of the highway to be designated, the natural values of the area which justify the designation and the future features and management that would be necessary. If future highway capacity improvements prove necessary, the measures to make such improvement possible would be identified in the management plan - wildlife crossings, fencing, signing, speed limit reduction, vegetation management, etc.

## Introduction

Let me start by saying that the views expressed in this paper are the authors and they should not be construed as the view of any persons or agencies associated with this conference.

Traditional methods of planning, project development, construction and maintenance are being revisited in light of our increasing knowledge of the relationships of transportation facilities and their rights-of-way to native communities and wildlife. It is recognized that in addition to being corridors for transportation, there are often natural values associated with these corridors that provide real opportunities for management which complements the native flora and fauna. It has also become evident that there are efficiencies associated with management for native flora and fauna which result in reduced rights-of-way management costs as evidenced by papers at this conference.

While there are opportunities in rights-of-way management, there are also limitations because of the transportation function of the corridors and the limitations this presents in what can reasonably be done. This paper presents a model for looking at highway locations and rights-of-way to identify opportunities for

designation as national Ecological Highways. This paper will also present approaches to developing and implementing management plans to improve the environmental relationships. Consideration would be given to the larger landscape ecology relationships that are present in some areas of the country so that the micro and macro-scale factors are considered when looking at highways.

## Background

Historically, roadway corridors have largely been based on transportation need in order to support movement of goods and people in a developing country. This perspective resulted in a wonderful system of highways to get people and goods to all areas of the country. The transportation system has also contributed to the economic growth and health of the nation. In the early years, there was little need to consider natural resource areas in the establishment of corridors because we had large pieces of the country with these natural resources. Under the programs to open areas for development and use of natural resources, the majority of today's transportation system was developed. With NEPA came the realization that the environment needs to be considered in the development of transportation facilities. Unfortunately, by that time, most of the existing major highway corridors had been established to connect the development already underway. With the accelerated growth and development during the late 1970's to today and the American love affair with the automobile, highways were improved and traffic levels have increased to the point that environmental problems with both existing highways and planned improvements have become evident.

Beginning slowly, the rate of growth of traffic and development has resulted in problems in many areas of the country and for that matter the world. Remnant populations of wildlife are being managed at great costs because of human population growth, associated development and the transportation system connecting this growth and development. Lack of environmental considerations in the past are causing problems for transportation agencies that find that some existing facilities are poorly located for upgrading while traffic levels dictate the need. Human safety then becomes a factor which results in a project that requires costly measures to remedy past mistakes.

New alignments also become a problem because the last remaining corridors are frequently through the last remaining areas of natural habitat.

Historically, for roadside management, turf grasses have been used for stabilization of roadsides on most highways. The grasses vary geographically in response to environmental factors such as soils, moisture and temperature extremes. The aesthetic standard was to have the appearance of a lawn or mowed field. In environments where the use of turf grass was not possible because of environmental conditions (i.e. desert, rocky areas, sandy seashore, etc.), native vegetation has been allowed to exist and occasional mowing has been used to keep the vegetation in early successional stages. In forested areas, allowing trees in the rights-of-way was more acceptable. However, federal safety standards require a 30' clear zone for motorist recovery should they leave the paved areas. The trend in many areas has been to eliminate the trees, resulting in grass rights-of-way corridors through the forests. This approach to rights-of-way management has resulted

in problems because in many areas the grasses are maintenance intensive and therefore not sustainable over the long run. The reworking of the shoulders of the highways on too frequent a basis is the result. The result has been a steady increase in maintenance activities and therefore maintenance budgets for taking care of these grass ecosystems. As national economics changes, the amounts of money for rights-of-way management can be expected to decrease. Therefore, it is important at this time that a new model for roadside planning, development, construction and management be implemented to insure sustainable ecosystems along our roads to protect these expensive transportation corridors.

#### Timing

Where in the process do we consider vegetation and wildlife? Just as timing is important to the various functions of the natural environment, it is also important when wildlife and habitat are considered in the highway planning process. These considerations need to be weighed in the earliest planning for an area. They need to be part of a comprehensive plan at the local level, state level, federal level and even international level. For most public lands, this would involve a management plan. Yet, the management plan can not be developed in isolation of other plans for the larger area. Activities in adjacent areas lead to preclusion of options in the management of public lands if not developed with consideration of the management plan for the public lands. Some activities are clearly in conflict with the management goals of our public lands to the point that they should be limited or eliminated from these areas. Early planning needs to cover the gauntlet from long-term species management to highway rights-of-way management. All need to be integrated into the larger plans to assure compatibility. If it is desirable to keep an activity out of an area, it should be identified early in the process and carried through to the implementation phase of land use development. Local and state land use regulations should not allow for these activities. Therefore, the first principle of our model for designation of a highway as an Ecological Highway will be that vegetation and wildlife management considerations need to be part of landscape level planning which is comprehensive (local, state, federal and international in some cases) and leads to early consideration of wildlife and vegetation in the planning process. For those highways identified as having associated natural resource values which warrant, an application for designation of the corridor or a portion of the corridor as a Ecological Highway would be made as a result of the values identified in this early planning process. The nominations would be generated at the local (government or private) level using the information obtained during early planning.

#### Method

A process similar to the Scenic Highways process would be used which requires a local advocacy for the designation. This advocacy group could be public and/or private. An application for eligibility would be made to determine if the natural values warrant the designation. Upon approval of eligibility a management plan which is coordinated with the local, state and federal plans for the area would be developed. The plan would contain specific recommendations for future features and rights-of-way management either as retrofit or with future improvements to the highway. For new alignments, the management plan would serve as the basis for project planning, development, construction and maintenance. Where future expansion of the facility is identified as problematic to the future management of adjacent lands and wildlife, this fact would be contained in the management plan to help dictate the future of the facility. In some cases such as highways through State or National Parks, Forests or Preserves, it may be desirable to limit increased capacity for the highways and recognize them as congested

corridors because they are designated Ecological Highways - Yellowstone National Park comes to mind.

An important factor in the management of highway rights-of-way is the human factor. The environmental spectrum covered by highway rights-of-way includes everything from landscape designs in the urban environment to the most pristine natural areas and everything in between. Ecological Highways would reach their greatest value at the pristine habitat end of the spectrum. This initial development of principles recommended for the model therefore is directed toward the natural end of the spectrum.

The beginnings of this model assumes that management of highway rights-of-way consistent with the management of adjacent lands will result in an acceptable approach for the majority of the motoring public. There are certainly exceptions to this rule especially in environments where blocking the view from both directions would be a more acceptable approach such as areas with clearcuts. Our next principle in development of our Ecological Highway model will be that in natural areas, management consistent with that of the adjacent areas will generally result in sustainable communities on highway rights-of-way and serve as the vegetative structure to maintain connectivity.

One of the principles learned in the biological sciences is that "mother nature" has a natural order for things - what should be will be, if left to natural succession. Many studies have been conducted in the ecosystems of the world to document what takes place after disturbance. Nothing is constant and natural ecological systems are constantly changing as are roadside conditions. Species that have evolved in these systems have adapted to the wide range of conditions typical to an area. Therefore, they are sustainable without maintenance except in some cases where man has eliminated a natural process such as fire or flooding.

Given that the plants in adjacent environments are in a natural successional process, the use of native vegetation representative of adjacent plant communities is logical. Therefore, for highways that are Ecological Highways the use of native species to the maximum extent possible should be a principle in our model. This can be accomplished by minimum disturbance of the rights-of-way, utilization of slopes similar to those occurring in the adjacent environments, replacing top soil where needed to support species similar to those in the adjacent habitat and reseeding or replanting native species into the rights-of-way. In some areas where erosion or motorist's safety are not issues, the natural successional process may be an acceptable way to allow natural revegetation without replanting.

Therefore, another principle of our model is the minimum disturbance of the rights-of-way in construction and maintenance. This is called limited clearing and grubbing and at different times in the past was practiced to the point of having limited clearing and grubbing plans with the construction plans for a facility. The use of this practice needs to be resurrected where transportation authorities have moved away from the practice. It should be part of the avoidance and minimization principles which are required in project development. If it is not disturbed, we do not have to deal with it after construction is complete.

In the areas which the corridor transects, less erosion problems will generally result if slopes similar to those in stabilized areas adjacent to the road are used along the rights-of-way. This may make additional rights-of-way necessary initially but these costs would be reduced in the long term by the reduced maintenance needs to stabilize an erosional slope. As part of the evolutionary process of the area, plant species have evolved which can best stabilize the slopes given similar soils and slope. Even in the larger areas of disturbance, the long term success of native communities in these disturbed areas will be better because of their ability to become established quickly on these more natural

slopes. Therefore, another principle in the model would be to use slopes representative of stabilized slopes in the adjacent environments.

It is impossible to construct a highway without some disturbance of adjacent vegetation to some degree. Contractors should be given incentives to minimize this disturbance. However, where disturbance is required to construct the job, the soil characteristics after construction will dictate the ability of native species to become established in the area. Top soils should be stockpiled and reapplied or soil amendments used to leave soils that closely match adjacent soils, where necessary. Therefore, native vegetation will reestablish more quickly. Our next principle will be the requirement of retention or replacement of representative soils in disturbed areas.

The seasonal aspects of vegetation are important to their reestablishment. Replanting vegetation or seeding during the dry season can only lead to the need for irrigation to support the vegetation. The timing of revegetation efforts is paramount to the success of reestablishment. Therefore, our next principle for the model will be timing the planting or seeding of native vegetation such that it has a growing season in which to become established. This will require timing construction so that vegetation replanting takes place before the growing season. Where this is impossible, temporary erosion control methodologies must be used until the beginning of the next growing season. Here in Florida, it may not be as critical because of our almost year long growing season but even Florida has a rainy and dry season which will influence the success of vegetation reestablishment. Irrigation of vegetation is expensive and the results are mixed because of lack of attention to detail by the contractors carrying out the irrigation. In most areas, this involves a water truck coming out periodically and dumping some water around the plants or spraying an area. This is a short term activity that generally does little to get roots established and therefore can result in failure of the plants at some point in the future.

For safety reasons, the Federal Highway Administration requires a clear recovery zone of 30' adjacent to the pavement on both sides of a highway. This is an area free of trees and other permanent structures which could present a safety hazard to motorists leaving the highway. Although these areas are not suitable for trees or large shrubs, they can be managed for native grasses, wildflowers and smaller shrubs where the adjacent environment has such species. One of the concerns with turf grass is that it is not native to most natural systems and therefore can and has invaded many native habitats. Our next principle will be that the clear zone will not have trees or large shrubs which could present a hazard to motorists but where possible native grasses, shrubs and wildflowers will be used in this zones on the Ecological Highways. Native shrubs which do not present a hazard to motorists can be used in this zone. In fact, shrubs will serve as energy dissipaters to slow a vehicle before it reaches a stationary object which could do substantially greater damage.

The resulting highway rights-of-way are a reflection of the adjacent habitats. The maintenance of these areas would also reflect the maintenance of the adjacent areas which in most natural areas is left to natural succession. The resulting communities will therefore be sustainable in the long-term. Maintenance would only occur in the recovery zone where periodic mowing or fire would be needed to keep vegetation in early successional stages.

This model is simple to apply on Ecological Highways with new construction or highway improvement projects but what about existing rights-of-way? In some of the more pristine areas, ecological restoration may be necessary to eliminate turf grasses and reestablish native species. In many cases, this will not be as extensive a process as may initially be anticipated. Left to her own devices, "mother nature" has a way of reclaiming subsidized vegetation features with native species when the subsidization is

removed (i.e. stop fertilizing and mowing). There is a natural tendency for native vegetation to invade the rights-of-way and the only thing keeping them from becoming established is the competitive edge given turf grasses with fertilizer and mowing. With reduced maintenance, these activities are eliminated and natural recolonization of these areas will take place. The advantage to promoting natural recolonization now is the reduced maintenance costs that will result immediately. The resulting ecosystems will often be extensions of often rare or declining natural ecosystems for the future.

This may sound rather idealistic but it is happening in that remnant ecosystems along rights-of-way are repositories of species lost because of man's disturbance or elimination of disturbance of adjacent habitats. They serve as sources for revegetation of native communities after the disturbance comes and goes. An example of this took place in Appalachicola National Forest where an endangered plant, Harper's beauty, *Haploecallis flava*, was occurring on the highway rights-of-way and fire had been eliminated from its native habitat. The Florida Department of Transportation modified the mowing schedule in the area and the species has prospered along the highway. With improved fire management in the forest, the plant will recolonize adjacent natural habitats. Our next principle for the management of rights-of-way will be to allow natural processes or management practices in the case of public lands to influence the vegetation on our rights-of-way. In fact, in large areas of public lands contracting the maintenance of rights-of-way to the public land managers may be a way to insure proper management. In fact, the Federal Highway Administration has developed a Memorandum of Understanding (MOU) with the Nature Conservancy to allow their involvement in rights-of-way management. Consistent with the intent of the MOU, the Florida Department of Transportation has contracted the Nature Conservancy to study methods of reintroduction of native species into rights-of-way for some native ecosystems.

This will certainly be a case-by-case decision since much of our public lands are not being managed wisely. In my travels throughout the west, it is evident that in many areas, the best land management is taking place on the highway rights-of-way since the other side of the fence is almost devoid of many native species because of overgrazing. In other areas where clear cutting is allowed, doing so in the highway rights-of-way would only compound the ugly scene and a vegetation barrier may be necessary. Again, if we leave these corridors in native vegetation, they will serve as sources of native vegetation should wiser public land management result in adjacent areas. Since many species native to these ecosystems are eliminated by these multi-use management practices, our public lands are losing native species to the point that many are declining. Even human use is being allowed in some areas at the expense of declining species.

#### Wildlife Aspects

Highway rights-of-way certainly have a wildlife component. It has been determined that wildlife using the highway rights-of-way for some portion of their life cycle are predisposed to danger from the traffic on the highway. Numerous papers at the 1996 wildlife mortality seminar and this conference document this problem. Some species have been successful in nesting along highway rights-of-way while others use them for feeding. They are even used for breeding areas for some species. Being an edge in many areas, they can provide both cover, feeding, breeding and nesting for some species.

Using the same principle of native species management that we used for plants, animals can also be evaluated in relation to the native habitats and species composition encountered in the adjacent habitats. In other words, with the exception of secretive species who would avoid going near the highway, the species using the habitat along the highway would be similar to that

utilizing the adjacent habitats. This necessitates a look at the larger ecosystems leading to the highways. The scale of the area needing analysis will be dictated by the scale of the landscape which involves wildlife which might have a relationship to the highway. For many species, the ability to move between habitats for portions of a life cycle is as important as the presence of that habitat. If you can't get there, it is of no use. Therefore, accommodation of wildlife movement across Ecological Highways will be important in those areas. Many of the presentations of this conference have addressed the need and methods for these accommodations.

Preclusion of some wildlife species from the rights-of-way is necessary in order to avoid mortality. Other smaller species with shorter life cycles can avoid or handle the mortality factor and can be managed for along highways. This can lead to the attraction of other species to the roadside to feed on the residents which makes them vulnerable to vehicle mortality. This could make barriers necessary to keep some species out of the rights-of-way in order to reduce this mortality factor especially along heavily traveled highways such as Interstates.

In relation to wildlife, our principle needs to be the management of wildlife that is naturally associated with the habitat both adjacent to and therefore physically on the rights-of-way with consideration of factors influencing the safety of the wildlife and the motorists. Larger comprehensive planning will be important for wildlife that use the rights-of-way for only some portion of their life cycle - feeding, breeding, movement, nesting, etc.

#### Management Plans

The management plan for the Ecological Highway designation will dictate the site specific principles necessary for a given corridor. These management plans would vary depending on the adjacent ecosystems and the management objectives of the adjacent land but the principles in this model are sound for most natural areas. The locations where multiple use land management is occurring is where variation may be necessary since some of these areas are not being managed for the full spectrum of native vegetation and therefore do not support the entire spectrum of native animals. Therefore, it would be unreasonable to expect a highway management plan to be held to a higher standard than the adjacent management plan.

Some areas will warrant more stringent management plans while others may strictly deal with one aspect of highway management such as native vegetation. The management plan will vary as different areas along the corridor are considered. Site specific recommendations will result. A key to success will be to tie the management plan for the highway to the site specific management plans for adjacent lands. For example, if the adjacent lands are not managed as wildlife corridors, it would make little sense to provide wildlife crossings in the highway in those areas.

#### The Process

The designation process would start with an eligibility determination which is a coordination process with local, state and federal participation. An eligibility document similar to those used in the Scenic Highway Program would be used. This document would contain:

- \* A Background Assessment
  - Describe the Highway and Rights-of-Way,
  - Existing Land Use and Zoning
  - Future Land Use and Zoning,
  - Safety Issues
  - Traffic Volume/User type

- Levels of Service - existing and future
  - Transportation Planning - existing and future
  - Roadway Improvements
  - Protection Techniques
  - Environmental Conditions
  - Other programs which are compatible or contradictory
- \* An Intrinsic Resource Assessment
    - Define Preliminary Corridors Limits
    - Corridor Impressions Survey (Qualitative)
    - Field Inventory (Quantitative)
    - Corridor Vision and Initial Goals
    - Research
    - Arrive at a Corridor Limits - based on information obtained
    - Participation Program - who will do what
  - \* A Corridor Management Plan
    - Identify Corridor Management Entities
    - Corridor Improvements/Enhancement
    - Consistency with Other Plans
    - Promotion - Local, State and Federal Advocacy
    - Administration/Coordination - Administration, Operation, Maintenance
    - Corridor Video and Graphic Depiction (GIS)
  - \* Implementation
    - Annual Reports - Corridor conditions, goals, funding, action plan updates
    - Five Year Management Update - what has been accomplished and needed changes

Needless to say not every highway that passes through a park or forest will make the Ecological Highway designation. The intent would be to protect the really significant corridors. Depending on the management plan developed individual features of a highway (vegetation or wildlife) could lead to the designation if an acceptable management plan is developed.

#### Conclusion

So now, we have these wonderful highways which are planned, developed, constructed and managed for at least some portion of the life cycle of rare and declining species in many areas of the country. Traffic increases to the point that improvements to these highways are necessary, after all they are transportation corridors. In the environmental studies, it is determined that because of the species occurring on the rights-of-way, environmental impacts will be significant with possible involvement with threatened and endangered species. For those in opposition to highway improvements, the result is additional reasons to oppose the project. The opposition is sufficient to stop the project. End result, the State Departments of Transportation will not support this otherwise necessary concept.

The second scenario is that these areas are Ecological Highways which are designated such in a national program to promote sound ecological management of those special areas of rights-of-way where natural values need to be consistent with adjacent land management. The program would recognize that the future need for transportation improvement may be necessary on some of these corridors. Others may be so important that future capacity improvements would be discouraged or prohibited. For those identified as needing future highway

improvement, this would be recognized in the designation and provisions would be made to allow disturbance of these areas given that appropriate avoidance and minimization is demonstrated. Every effort would be made in the design of the improved highway to allow for recolonization of important species. Connectivity for wildlife would be a component of the management plan for those facilities needing these features. The designation would also allow for wildlife considerations in the planning, project development, construction, maintenance and operation of these facility. These would be the most important wildlife areas warranting motorist education, reduced speed limits and wildlife crossings, etc. These would be the public lands where land management is consistent with the values that would be protected on the highway rights-of-way and adjacent areas. Given national exposure to the program, the motorists would better recognize these as areas where they need to demonstrate greater care to avoid impacts to wildlife.

They could be identified on highway maps so that motorists who need to get somewhere quickly can avoid the highway if reduction of speed limit is a factor. This is the case in Yellowstone National Park where the 45 mph speed limit is necessary for both human and wildlife safety. Highways through these areas would be recognized as national Ecological Highways. Motorists would become educated about the importance of these areas, resulting in greater responsiveness to the wildlife mortality problem. Highway money would be spent in public areas where the long-term management for important species is guarantee, thereby reducing the expense of measures to a more acceptable dimension from both a highway and ecological perspective.

The aforementioned management plans would nominate highways for this designation and contain the biological and land use information to support the nomination. The larger landscape perspectives would describe the importance of the Ecological Highway to the larger picture. Arguments would be made for future transportation improvements along the corridor so that public involvement could begin at the earliest stages of transportation planning for those corridors felt important enough to preclude future capacity improvements.

There will be areas that are important but will never make the National Highway Ecological Resources Management Areas designation. However, the mere process of consideration of these highways for the designation will raise the level of consciousness about the important environmental features associated with the corridor. Therefore, the net benefit would be positive.

In conclusion, I hope that this conference can be a jumping off point for exploring the possibility of developing a national Ecological Highway system.