Connectivity in Environmental Monitoring

Overview

Connectivity and fragmented landscapes are related to each other where corridors connect landscapes that have been divided by human influence. Connectivity is also referred to as corridors. Landscape ecologists have found that connectivity in fragmented landscapes is essential to the survival of plants and animals. Without these corridors, plant and animal species cannot migrate from one patch to another so that they can increase their genetic diversity, which increases their survival rate. Without genetic diversity, the population would become extinct.

The quality of the connective corridor to the fragmented patch is very important for species survival. In the articles, the researchers experimented with different environments, which would be considered corridors to other fragmented patches. The researchers explored the use of fencerows in agricultural fields to see how plants and animals would travel from the forest patch to an agricultural field then back to the patch of forest. They explored the use of a riparian corridor to see how predator animals moved through these corridors or if they used them at all. The scientists experimented with different types of man-made corridors in a national park to see how these man-made corridors could help protect the animals from cars and if the animals would actually feel comfortable using these corridors. In the journal papers, the researchers explored how animals would react and migrate in a patch of landscape that was used as a logging area. The logging area is heavily managed with man-made corridors. The researchers wanted to see how small animals would react to this environment. They wanted to find out what effect this would have on them and to see how the animals would react to man-made corridors connecting different types of fragmented landscapes together in this highly and constantly changing landscape. The scientists have also found that the quality of the corridor plays an important role in the survival of the plant or animal in the corridor. If the corridor does not have the right condition and level of protection, the animals would not use it and would try to find other routes to use in order to increase their genetic diversity. The plants need the right weather conditions in order to migrate from one corridor to another because they rely on other methods of transportation. The wind has to be blowing in that particular direction and then the animals must pick up the seeds from the plants and transport them to another site. Hopefully, this other site would have the right soil, sunlight, and nutrients for that plant species to grow to adulthood and start the migration process all over again. The scientists used a wide variety of corridors to study their effects and have found that connectivity to other fragmented landscapes is very important to the survival of a species.

In the articles, the scientists investigated many different types of matrix. One is the metapopulations. A metapopulation is “populations existing in discrete habitat patches as a result of the fragmentation of intact habitat into a variety of human land uses” (from web site Implications of Pattern). This plays a role in “corridors are assumed to be essential for the persistence of metapopulations in fragmented landscapes.” (Van Dorp’ et al. 1997) In the articles, the scientists experimented with the width of the corridor. The width of a corridor is important because it can determine the dispersal rate of a plant. If the corridor were too narrow, the plant would not migrate too far and would not get to the next patch. The reason the plants
are not able to migrate too far with a narrow or small opening to the corridor is due to wind dispersed seed crops. If the corridor is wide, the plant species would have a better chance to migrate and the species would have a continuous corridor strip as they pass through the corridor to the other patch. The habitat quality of the patch is important for the corridor. Corridor width is just as important to animals as it is for plants. For the animal, the corridor has to offer protection from predation, food, and water if the corridor is long. The patch habitat is important to animal species. It has to have enough nutrition to support the migration through a corridor in order to have movement from one patch to another. The next important quality of the corridor is the type of corridor—whether it is a fencerow in an agricultural field or a man-made corridor under a highway.

The corridors are also species dependent. They have to have the right cover, type of vegetation, moisture, and elevation for the animals to feel comfortable enough to use the corridors. If the conditions are not right for a specific species, they might not migrate to other patches. "The quality was defined by the survival rate of animals using the corridors, since this factor has the most fundamental effect on demography." (Henein et al. 1990) In the articles, the scientists performed different experiments on different types of corridor. One is a fencerow, which is used by small animals in agricultural fields where the small animals feel safe in the tall grass that is associated with a fencerow. In the McDonald paper, they experimented with man-made corridors in a national park. These corridors were covered structures that were constructed over the highway. The researchers "studied the effects of size, vegetative cover at entrances, and distance from home ranges as determinates of crossing structures." (McDonald et al. 2004) In this study, they translocated murid rodents to different places in the park and then designed different structure or corridors for the fragmented landscape and for highways. They used the different corridors and painted the bottoms with fluorescent dye in order to track what animals were using these structures. The results of this study showed that small animals used the man-made structures that were used in the study. The small animals used the corridors to cross the highways and road to get to other fragmented patches. If the structures were in their home range, the entrance was not too big and it provided cover from predators. The use of man-made corridors in urbanized areas is a great idea because it helps the plants and animals move from one place to another without having to interfere with the flow of traffic or everyday life.

Some other papers that I read, explored the use of genetics as a way to study how effective corridors or connectivity are to connecting one patch or another. The scientists are experimenting with genetics to help increase the accuracy and to check to see if the radiotelemetry and mark-recapture methods are saying that the animals are migrating and using the corridor. However, are the animals staying and reproducing with new genetic species or are these animals just passing through and moving on to another patch. The use of genetics would hopefully answer these questions. By using genetics, the researchers can determine if migrant animals using the corridors are successfully breeding. "In addition, molecular techniques measure effective dispersal, the amount of gene flow between populations." (Mech et al. 2001) In this study, the researchers want to determine "if corridors are effective in maintaining population connectivity, the genetic distance between populations connected by a forest corridor would be close to that for a contiguous forest. Alternatively, if corridors are not effective, then the genetic distance should be similar to that of populations separated by clearcuts." (Mech et al. 2001) The use of genetics as a way to check on the radiotelemetry, mark-recapture methods, and other methods that are used would indicate whether the animals that are migrating and using these corridors are staying in the new patch and are breeding to increase their genetic diversity. I feel that using genetics to monitor the species—both animals and plants—is very effective to the study of connectivity because it shows how all the other studies are
doing. This would actually tell if conclusive results indicate that the animals are reproducing to increase the genetic diversity, within their species. If an animal or plant does not have enough genetic diversity, the species would become extinct and there might not be a way to reintroduce those species back into that habitat. If scientists can find related species from elsewhere in the country, they could use translocation to that particular habitat.

The state of knowledge for the study of connectivity in a fragmented landscape is that it continues to grow and develop into useful information on what types of corridors should be preserved for as many different species of plants and animals as possible. The science behind connectivity is constantly growing and evolving from the use of remotely triggered cameras, genetics, GIS graph theory, and models, which explain dispersal and movement rates of specific animals. Scientists create numerous corridor types to help study what animals and plants like in a corridor so that the contractors and conservation managers can implement new ways of thinking. There have been many studies and science seems to be evolving with new studies and information but more studies are needed to truly understand how connectivity effects the survival rate of plants and animals.

The study of connectivity in a fragmented landscape is extremely important for environmental monitoring because we are constantly changing the natural environment by building Wal-Mart’s, Malls of America, and the ever-expanding residential communities. It seems that people forget about the plants and animals. People feel that they own the planet and have a right to build wherever they want ignoring the environmental impact that it is having on this planet. Monitoring corridors would ensure the survival of plant and animal species because everyone on this planet is a symbiont to one another. In the articles that I have read, “Corridors have been widely advocated as essential components of reserve design because they connect isolated areas of suitable habitat and thus minimize the harmful effects of habitat fragmentation on animal movement.” (Henein et al. 1990)

Annotated Bibliography


Learning and understanding how animals act in response to movement throughout the landscape is important in assessing how the animal behaves in the corridors that they use to migrate from one patch to another. The dispersal rate for the movement is also studied in order to determine if there are any patterns in their movement or a specific length of time it takes them to move. This is important in assessing the quality of connection between the fragmented landscape in order to assess how the animals are moving so that researches can give their results to land managers or planning boards in order to better help preserve important corridors.


The theory discussed uses GIS to implement algorithms and compact data structures to help determine where corridors are connected to fragmented landscapes for minks to use. The graph theory could be used as a tool to help with further study of an area for connectivity of a fragmented landscape.

This article is an outline of general landscape principles that are used. The first principle talks about scale of the study site. The second discusses patch-corridor-matrix, which is the structural pattern of the patches, corridors, and matrix of the landscape. The third principle discusses large natural-vegetation patches, which are protected aquifers, streams, and large fields. These are a few of the principles mentioned in the article and they are used as examples of different types of corridors. I found this article to be an overview of what should be assessed when examining connectivity in a fragmented landscape. These methods or principles give a starting point for investigators to begin looking at corridors.


In their studies the researchers experimented with different size, shapes, and habitat qualities of corridors, which connect fragmented landscapes together. They also modeled the estimate of dispersal moved over the landscape. They showed that dispersal tendencies depended on the quality of the connective patch. The model that estimated the dispersal rate based on patch geometry and dispersal success based on distance moved from one fragmented patch to another could be employed by other researchers in this field.


This monitors the wine-grape growing region of California on the idea that large mammalian predators prefer to use corridors rather than the surrounding developed landscape. The study used two riparian corridors to test this theory. They used the Russian River and the Sonoma Creek to do their experiments using remotely triggered cameras to determine the species that used the riparian corridors. I found that this paper should be given to the wine vineyard managers and owners so that they can plan their vineyards in order to accommodate and live with mammalian predators.


The authors discuss using highway-crossing structures to link areas of the landscape that have been fragmented by highways and roads going through the park. This study would give some results that show the use, translocation, and highway-crossing structures for small animals. This is useful if it offers protection from predators and provides good cover.


The study explores a deer mouse population in coniferous forest managed for timber in Washington State. The experiment set up different environments of corridors to determine how the mice were genetically moving from one patch to another. This paper was interesting because it explored genetics and how logging company managers can clear cut and still
maintain the habitat. I feel that more of this work should be taking place not only for logging but other areas where humans disturb the environment.


Corridor intersections have an influence on the dispersal rate of seeds in the corridor. The different shapes of the intersection also play an important role on how the seeds are dispersed from birds and mammals. The landscape of the intersection is also important for the plant species dispersal since it would depend on what the land cover is and whether it is a fencerow or tall trees.


Genetics were used to explore the consequences of fragmentation on whether these fragmented landscapes had corridors so that the different species could improve on the genetic diversity. The species were sampled from all of Europe including the Alpine Alps. Wide varities of species were used in the study, which makes it applicable to many other scientists. Birds, brown bears, wolverines and many others were genetically sampled.


The study investigates the perennial grassland species with short-range seed dispersal over elements like ditch banks and roads that might be used as corridors for this species. The method that was used was the cellular automation model of the principal factor rates of migration. For this study, many parameters have to be taken into account for the corridor type, for the dispersal of seeds, the corridor width, habitat quality of the patch, and dispersal capacity. With the migration rates of plants in a grassland, this is hard to determine because of the many complicated variables previously mentioned in the above statements.

Other References

Implications of Pattern Populations and Metapopulations web site
http://www.env.duke.edu/lel/env214/le_popn.html