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Executive Summary

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Ecological Effects of Fragmentation Related to Transmission Line Rights-of-Way: A Review of the State of the Science

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EXECUTIVE SUMMARY

Date of Report: June 30, 2004
Title of Project: Ecological Effects of Fragmentation Related to Transmission-Line Rights-of-Way: A Review of the State of the Science
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Institution: Resource Strategies, Inc.
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Object of Research:

This project was conducted to provide four key types of information: (1) a summary of the current state of scientific research on the ecological effects of fragmentation related to rights-of-way (ROWs), (2) a picture of how this research relates to transmission-line ROWs in Wisconsin, (3) insight into the limitations of the current research, and (4) recommendations for future research. A comprehensive search of the relevant literature has been supplemented with interviews of Wisconsin experts, intended to give readers a local perspective. This combined approach was chosen to provide policy makers and interested citizens with a valid non-technical reference on the ecological effects of fragmentation. The information can be used to construct a systematic course of action for addressing the research gaps that are most important to understanding the ecology of fragmentation and transmission-line routing in Wisconsin.

In addition to the report that integrates the literature and interviews and outlines the research gaps, this document includes a list of all references cited in the report, abstracts of all cited studies carried out in Wisconsin, and a table of information on Wisconsin species that have special ecological requirements.

Summary of Results:

Ecological Effects of ROWs

The ecological effects produced by linear ROWs can be grouped into two broad categories: habitat fragmentation, which generally has negative effects; and ROW corridors, which have both positive and negative effects. The findings that are discussed in the report pertain primarily to ROWs through forested land because that is the type of landscape that exhibits the most measurable effects.

Fragmentation. A ROW can separate a previously intact ecological landscape into fragments. Although very little has been written specifically about fragmentation related to transmission-line ROWs, general findings about fragmentation are relevant. They are divided into three topics: effects of reduced habitat area, effects of species isolation, and effects of increased edge habitat. The most significant effect produced by transmission-line ROWs is increased edge habitat, which tends to benefit common species at the expense of those that are rare or threatened.

Corridors. There is also a paucity of literature that discusses transmission-line ROW corridors directly; however, general findings on corridors are relevant. They are divided into two topics: the effects from the creation of new, early successional habitat and the effects of connectivity and species movement—including invasive species—provided by the corridor.

Transmission-Line ROWs in Wisconsin

A transmission-line ROW represents a special case of development-produced ecological effects. It is characterized by a long, linear strip—often of contrasting vegetation—cutting through a landscape. Because a ROW is narrow and vegetated, the effects of fragmentation are limited compared to some development activities, such as road construction; however, a transmission-line ROW does present its own specific subset of ecological consequences. This report identifies the three ecological effects that are most significant for Wisconsin.

1. *Fragmentation—Effects of increased edge habitat.* Some plants and animals are area sensitive and therefore may be threatened by a reduction in habitat and forced isolation; others do not suffer from, and may not even be aware of, any separation caused by the relatively narrow width of a ROW. Increased edge habitat is the most significant of the ecological consequences associated with habitat fragmentation by ROWs in Wisconsin. Because of their linearity and vegetation management practices, transmission-line ROWs produce a high proportion of edge habitat relative to the overall area of the interrupted land use. Increased edge is credited with boosting local species diversity through formation of new habitat; however, the added species, such as deer, often are already

abundant and thrive at the expense of rarer species. Increased edge habitat also exerts negative pressure on resident populations through brood parasitism and predation, both potentially responsible for declining songbird populations in Wisconsin.

2. *Corridors—Early Successional Habitat.* Plants and animals that thrive in open and early successional habitat, such as the federally endangered Karner blue butterfly, can do very well in a ROW. In fact, the abundance of the Karner in Wisconsin represents a successful outcome for ROW management in the state.

3. *Corridors—Invasive Species.* The ROW corridor can help some species overcome the potential isolation related to fragmentation by facilitating movement among remnant habitat patches but it also allows for movement of invasive species, an issue of great concern to Wisconsin scientists. For example, in Wisconsin a ROW can facilitate movement and abundance of the federally endangered Karner blue butterfly but also of the invasive spotted knapweed, particularly detrimental to Wisconsin's open areas.

Limitations of the Research

There are three general limitations in the research that overlie all others. First, ecologists do not have enough information about the distribution, abundance, reproductive and habitat requirements, and interactions of plants and animals to determine what development activities will affect particular populations. For example, some groups, particularly plants and insects, may be significantly affected by ROW-induced isolation; however, a lack of general ecological knowledge makes it difficult to identify the affected groups or individual species.

Second, there are not many studies that relate specifically to the ecological effects of transmission-line ROWs. The small body of literature that has been published on this topic lacks coherence and organization. Consequently, it is difficult to form a complete picture of the situation.

Third, many studies discussed in this report and almost all of the studies specific to ROWs are short-term and/or species-specific. In order to determine the effects of fragmentation caused by ROWs, scientists need to have an understanding of the baseline—the assemblage of species that existed in an area prior to construction disturbance—before they can conduct meaningful research that could establish a causal relationship. General trends can only be identified when studies examine a number of species over time. ROW-induced fragmentation may result in effects that are not perceived because they occur a long time after construction or they affect species that are not studied because they are deemed unimportant in relation to economic activity or conservation in the state. The most useful studies would be longitudinal field studies measuring the abundance and distribution of a variety of species in a site before construction of a transmission-line ROW and for a period of time after construction.

Future Directions:

Gaps in the Research

Gaps in the research correspond to the three ecological effects of fragmentation related to transmission-line ROWs described above as most significant in Wisconsin.

Increased edge. The changes associated with construction of transmission-line ROWs include effects that vary in both magnitude and importance. In terms of overall impact relative to more intrusive landscape changes, ROWs cannot be considered major factors in reduced habitat area or increased species isolation for a majority of plants and animals; however, they have a significant impact on increased habitat edge. Without a doubt, edge effects are the most significant ecological outcome of fragmentation resulting from ROW development. A number of possible topics for future investigation of the effects of increased edge habitat are outlined in the report.

Early successional habitat. Although the early successional habitat created by transmission-line ROW corridors is generally viewed as beneficial for some plants and animals in Wisconsin, there are limited data on the species that inhabit ROWs, especially those that are endangered, threatened, or of special concern, and whether or how they profit from this type of habitat.

Invasive species. The relationship of ROW corridors to connectivity and movement of invasive species in Wisconsin is not well-documented. Much of the concern regarding invasive species is a result of observations and anecdotal evidence.

In reviewing the gaps in the research relevant to the ecological effects of fragmentation related to transmission-line ROWs in Wisconsin, it is clear that future research must be part of an overall framework of investigation with defined goals. Determination of next steps should be made with the elements presented in this report in mind.