IMPLEMENTING HABITAT MITIGATION FOR GREATER SAGE-GROUSE UNDER THE CORE AREA APPROACH

Purpose

This whitepaper outlines interim guidance for development of Oregon Department of Fish and Wildlife (Department) habitat mitigation recommendations associated with renewable energy development and associated infrastructure or other landscape scale industrial-commercial developments in greater sage-grouse (hereafter sage-grouse) habitat in Oregon. This guidance is interim until empirical data are available that quantify the effects of such development on sage-grouse populations.

This whitepaper only focuses on sage-grouse habitat needs as it pertains to sagebrush. There may be other species that also require mitigation. Sagebrush habitats not in Core or Low Density areas may serve as important linkages for sage-grouse movement and provide habitat for sagebrush dependent species. These habitats will be categorized under the Department's Mitigation Policy, but such sites will be evaluated on a case-by-case basis to determine appropriate classification.

The framework outlined below provides a methodology for quantifying only the area of impact. Basic project design rules or stipulations related to construction and maintenance (e.g., micro-siting, timing restrictions, general project design) would remain an integral part of recommendations to decision-makers.

These recommendations are to be implemented under the Core Area approach as described in Oregon's Greater Sage-Grouse Strategy (Hagen 2011). Specifically, the proposed method of habitat quantification is intended for projects that will impact sage-grouse habitat. See **Attachment 1** for hypothetical example of this approach.

Background

The Core Area approach identifies two macro-scale classifications of sage-grouse habitat: Core Areas and Low Density Areas. At the macro-scale the Department's recommendation is to avoid impacts to sage-grouse habitat in Core Areas, which cover approximately 90% of the breeding population in Oregon. Where impacts cannot be avoided in sage-grouse habitat in Low Density Areas, mitigate those habitats such that there is "no net loss and with a net benefit." Per the Department's Mitigation Policy (OAR 635-415-000) habitat mitigation should be "…through reliable in-kind, in-proximity habitat mitigation to achieve no net loss of either pre-development habitat quantity or quality." In proximity, is defined as either within the home range or watershed (4th field HUC) whichever is most likely to provide the greatest benefit.

Recommendations

As project proposals are submitted to land management and planning authorities, Department biologists will consider available information, including on-site analysis to determine:

1) Are the habitats those upon which sage-grouse depend?

2) Is there evidence of sage-grouse presence?
3) Is the site-specific habitat both essential and irreplaceable?

If the project is in a Core Area and a site specific analysis results in the answer to these questions as yes, then the Department recommendation will be to avoid impacts to those habitats, to be consistent with Habitat Category 1 habitat recommendations (per ODFW Mitigation Policy).

Note: The Department acknowledges that not all habitats or areas within Core Areas are considered sage-grouse habitat. However, sage-grouse habitats with evidence of sage-grouse presence in Core Areas are typically considered both essential and irreplaceable for the following reasons.

1) Where there is sage-grouse habitat within Core Areas, any loss or fragmentation of sage-grouse habitat would be expected to result in population declines. Thus, sage-grouse habitat within Core Areas is considered essential (per ODFW Mitigation Policy).

2) Due to the long period of time (years to decades) required to restore sagebrush habitat upon which sage-grouse depend and because of the uncertainty involved in the successful in-kind mitigation for any loss of sage-grouse habitat within Core Areas, both in quantity and quality, sage-grouse habitat within Core Areas with few exceptions will be considered irreplaceable (per ODFW Mitigation Policy).

If the proposed project is in a Low Density Area with sage-grouse habitat and evidence of sage-grouse presence and impacts cannot be avoided, the recommendation will be to mitigate for those habitats such that there is "no net loss and with a net benefit", to be consistent with Habitat Category 2 habitat recommendations. Sage-grouse habitat is identified as all sagebrush types or other habitats (e.g. wet meadow brood-rearing habitat) that support sage-grouse.

Typically, the Department's determination of the appropriate mitigation habitat category for any given project area is conducted in consultation with representatives of the appropriate land management and/or planning authority and the project applicant. Ultimately however, it is the Department's obligation to determine in which mitigation habitat category the proposed project occurs.

Mitigation actions

Quantifying impacted area relative to noise production–There is a paucity of empirical data on the impacts of renewable energy development on sage-grouse populations. Based on current research, direct impacts of project appurtenances (e.g., roads, transmission lines, pipelines, turbines, etc.,) and disturbances associated with operation and maintenance activity are likely similar to those from energy developments throughout the Intermountain West (Becker et al. 2009, Hagen 2010). The ecological footprint of these impacts for renewable energy developments has not been quantified. However, there is recent science that demonstrates the effects of noise on sage-grouse breeding behavior (Crompton and Dean 2005, Holloran 2005, Blickley and Patricelli *in press*). In brief, sound levels >40 decibels (dbA) reduced breeding activity and increased stress levels (as measured by hormone levels) in sage-grouse (Blickley and Patricelli *in press*). Additionally, an evaluation of noise impacts on lesser prairie-chickens indicated that abandoned leks were exposed to greater noise levels (34.8 dbA) than occupied leks (30.4 dbA) in New Mexico (Hunt 2004).

Therefore, the Department recommends use of noise propagation models to identify habitat area impacted as defined by noise levels >40dbA, as well as a surrogate for other impacts. The noise propagation models and input parameters should be consistent among projects and follow the Oregon Environmental Quality Commission (EQC) standards (e.g. Oregon Administrative Rule 340-035-0035) as recommended by the Energy Facility Siting Council (EFSC) in their Model Ordinance (e.g., ver. 2, July 2005).

Models are readily adapted to GIS where the noise model would overlay the available vegetation and ecological site descriptions (ESD) for the project area and vicinity. The acreages of sage-grouse habitat occurring within this area would then be quantified as a function of both vegetation and the underlying ESD. Since the area of impact is based on the expected biological consequence of noise, it may exceed the project area boundary. Identifying the entire area of expected biological impact will assist in achieving a no net loss with net benefit for habitat mitigation.

Additionally, output from the noise propagation model should be binned into 5dbA contours from highest to lowest potentially affecting sage-grouse (40 dbA). The Department recommends that acreages of each contour be weighted by a habitat disturbance score (HD) and then adjusted by a mitigation ratio assigned to it (Table 1). Disturbance scores are designed to account for diminishing affects on habitat as a function of distance (Gaines et al. 2003). Those contours ≥50 dbA will have mitigation ratio of 2:1 acres to mitigate for likely permanent loss of habitat proximate to infrastructure and the area with, most likely, the greatest impact by indirect effects on habitat use. Those habitats encompassed by contours 40-50 dbA will have a mitigation ratio of 1:1 to mitigate for indirect effects of the development on sage-grouse habitat use. These ratios are based on the untested assumption that they are adequate to replace enough habitat off-site to compensate for the impacted population of sage-grouse on site.

Table 1. Recommended habitat disturbance and minimum mitigation ratios used for calculating mitigation acres for Low Density and non-core sage-grouse habitats in Oregon.

A-weighted decibels contours	Habitat Disturbance	Mitigation Ratio
<40	0.00	0
40-44.9	0.10	1:1
45-49.9	0.40	1:1
50-54.9	0.70	2:1
≥55	1.00	2:1

For example, a project site has 150 acres of sagebrush habitat in the 60-65 dbA, the acres calculated would be 150 x 1 (HD) x 2 (Ratio), = 300 acres of sagebrush. Additionally, 1,000 acres of sagebrush was identified in the 50-55 dbA and would equate to 1,000 x 0.7

x 2 = 1,400 acres. Taking the sum of adjusted acreage of sagebrush in each contour would be the minimum total acres for which to mitigate.

Although the exact composition of habitat and ESD acreages would be difficult to replicate exactly, the goal should be to identify a mitigation site with similar ESDs and capability of supporting a similar sagebrush community.

Non-core sagebrush steppe– Sagebrush habitats outside of Core and Low Density Areas (referred to as "non-core") may serve as important linkages for sage-grouse movement and/or provide habitat for other sagebrush dependent species. Generally, these habitats should receive a Category 2 habitat recommendation under the Department's Mitigation Policy, but such sites will be evaluated on a case-by-case basis to determine, importance to other species, appropriate habitat classification, and mitigation category.

Site selection– If following on-site confirmation of sage-grouse habitat and evidence of sage-grouse presence in Core Areas, there is no mitigation action identified for these projects because these habitats are considered essential and irreplaceable as defined in the Mitigation Policy and should be avoided (See rationale on page 2 under **Recommendations** section).

To meet the objective of the Mitigation Policy with respect to sage-grouse habitats within Low Density Areas, mitigation sites will be prioritized and selected based on the following criteria (in order of preference):

1) Core Areas that occur within a Conservation Opportunity Area (COA) or other landscapes with on-going sage-grouse conservation actions;
2) Core Areas that occur outside of a COA;
3) Low Density Areas that occur within a COA or other landscapes with on-going sage-grouse conservation actions;
4) Low Density Areas that occur outside of a COA.

COAs are landscapes of high biological integrity as identified in the Oregon Conservation Strategy (ODFW 2006). These areas have an increased likelihood of success with respect to conservation actions, and should benefit sage-grouse and other sagebrush dependent species. The sage-grouse population size of the impact area may also be considered when selecting a mitigation site. Mitigation sites should be of similar habitat potential, but may be of lesser quality. Mitigation sites of lesser quality should be selected based on the potential success for the habitat to be enhanced or restored to the same quality or better as the habitat impacted. Mitigation ratios may be increased based on quality of the mitigation site, to account for increased risk associated with restoration of lower quality habitats. Thus, a mitigation site with early phase juniper invasion would have a high likelihood of success in achieving habitat improvement. Alternatively, a potential mitigation site that has extensive cheat grass (*Bromus tectorum*) or medusahead rye (*Taeniatherum caput-medusae*) invasions would have a low likelihood of success for habitat improvement and should be avoided in selection for a mitigation site.

Roads.– Habitats should be mitigated that are directly impacted or indirectly affected (i.e., changes in habitat use) by access roads to a project area. When a project uses existing roads, mitigation would still be appropriate if it results in increased traffic and change in traffic volume status (Table 2). The impacts of roads on sage-grouse largely depend upon the type of road and the amount of traffic (Holloran 2005, Wisdom et al. 2011), but again the effects have been mixed (Johnson et al. 2011).

To calculate the area of impact for new road development in sage-grouse habitat disturbance bands between 0.2 to 1.0 miles on either side of the road should be used (Table 2). Moderate and High Traffic roads should use habitat effectiveness weightings to model disturbance as a function of distance (Table 3). Traffic volumes will be determined based on operational levels of a given facility, and will use total traffic count in a 24 hr. period (midnight to midnight), regardless of how vehicles are spaced (i.e. will not distinguish between two vehicles traveling together vs. two vehicles traveling independently separated by some period of time). Again, ecological site data and current vegetation condition should be used to assist in targeting appropriate mitigation sites.

Table 2. Recommended width of disturbance bands to be applied to each side of a road based on traffic volume for calculating mitigation acres for Low Density and non-core sage-grouse habitats in Oregon (Subdivisions of Moderate and High Traffic disturbance bands provided in Table 3.)

Road Type and Status	Disturbance band (miles) [a]
Low Traffic (0-2 vehicles/24 hours[b])	0.20
Moderate Traffic (3-8 vehicles/24 hours[b])	0.50
High Traffic (>8 vehicles/24 hours[b])	1.00

[a] Distances summarized from Holloran 2005, Johnson et al. 2011, and Wisdom et al 2011.
[b] 24-hour period defined as midnight to midnight. Traffic volume categories adapted from Johnson et al. 2000.

Transmission Lines– Habitats that are directly impacted or indirectly affected (i.e., changes in habitat use) by transmission lines to the project area should be mitigated. The effects of transmission lines on sage-grouse and other lekking grouse species is not well understood. However, Ellis (1985) documented displacement of a lek by 0.75 miles after a transmission line was built. Hagen et al. (2011) found displacement of summer habitat use and movements of 0.47 miles by lesser prairie-chicken post-construction. The spatial distribution of leks in Oregon is such that 90% and 80% of leks are greater than 1 and 2 miles, respectively, from the nearest transmission line (ODFW 2009). Thus, at a minimum, a disturbance band of 0.6 miles on either side of the line should be used to calculate area of impact. Four subdivisions of the disturbance band at 0.15 mile intervals around the transmission line should be used to quantify habitat effectiveness as it relates to the proximity of the line (Table 3). The noise propagation model will not be applied to transmission line corridors, unless warranted by associated infrastructure. Use of ecological site data and current vegetation condition is recommended to assist in targeting appropriate mitigation sites.

Co-location of transmission lines is encouraged. Impacts from existing transmission lines constructed prior to 2002 will be considered fully realized. Thus, no mitigation would be required where habitat disturbance weightings of the existing line exceed habitat disturbance weightings of proposed transmission (calculated by applying same guidance outlined in this paper to both existing and proposed transmission lines). Where the habitat disturbance weighting of existing line is less than proposed transmission, the difference in habitat disturbance weighting would be applied to determine recommended mitigation (See following section for calculations).

Calculating Habitat Disturbance for Roads and Transmission– The Department considers transmission lines and High and Moderate traffic roads to be significant impacts to sage-grouse (Table 3). To account for diminishing effects of distance from these roads as well as transmission lines, a habitat disturbance (HD) weighting is applied to each disturbance band to calculate area of impact. For example, a proposed high traffic road that would impact 400 acres (per the disturbance bands) of sage-grouse habitat would be adjusted based on the amount of acreage that occurred in each disturbance band. Hypothetically, if the 400 acres were equally divided among each of the four subdivisions of the disturbance band (100 acres of sage-grouse habitat in each subdivision), the result would be 240 acres of recommended sage-grouse habitat mitigation.

Table 3. Habitat disturbance (HD) weightings for calculating mitigation acres. These HDs are estimated as a function of distance from roads and transmission lines in Low Density and non-core sage-grouse habitats in Oregon.

High Traffic Rds Distance (mi)	Moderate Traffic Rds Distance (mi)	Low Traffic Rds Distance (mi)[a]	Transmission Distance (mi)	HD[b]
0.00–0.25	0.00–0.20	0.00–0.20[a]	0.00–0.15	1.00
0.25–0.50	0.20–0.30		0.15–0.30	0.80
0.50–0.75	0.30–0.40		0.30–0.45	0.40
0.75–1.00	0.40–0.50		0.45–0.60	0.20

[a] Appropriate mitigation, if any, will be negotiated based on traffic levels.
[b] Habitat disturbance (HD) weighting applies across all columns. Note differences in distance bands and disturbance factor.

Conservation actions– Once an appropriate mitigation site has been identified habitat conditions will be assessed. A baseline assessment conducted in conjunction with Department staff is necessary to identify factors limiting productivity of sage-grouse habitat at a mitigation site. Similarly, effectiveness monitoring is necessary to measure the success of mitigation actions. The list below provides steps to identifying conservation actions and ***a partial list*** of potential activities to improve or enhance sage-grouse habitat at a mitigation site.

1) Evaluate habitat related factors that may be limiting population growth of sage-grouse in the area
2) Identify actions to improve habitat quality, which may include:
    a. Juniper removal

   b. Reduce risk of wildfire (e.g. suppression efforts, fuel break placement, invasive species reduction)
   c. Prevent invasive weed establishment
   d. Eradicate existing invasive weeds
   e. General improvement of sagebrush habitat condition
   f. Fence marking or removal
   g. Control access that compromises habitat effectiveness
3) Maintain mitigation site habitat quality, after improvements, for the life of energy project impacts
4) Secure assurances that a mitigation site will not be developed for the life of project impacts which includes any subsequent project re-authorizations. Permanent or near-permanent impacts could include a conservation easement or simple fee purchase of the mitigation site, to assure habitat values are protected in perpetuity.
5) Conduct periodic (3-5 year) on site mitigation effectiveness monitoring for the life of project impacts, thereby acknowledging that project impacts may exceed life of project authorization.
6) Scientifically accepted methods of monitoring vegetation and sage-grouse population responses to mitigation actions will be necessary to adaptively manage the mitigation site and future developments.

Monitoring– This Framework recognizes two general types of monitoring for ongoing operation of a particular development: basic research and decision support. Basic research includes developing and implementing detailed studies to evaluate impacts of various developments on sage-grouse life-history, and/or the response of sage-grouse to mitigation actions. Such studies will assist in an understanding of the broader context of future location and mitigation for renewable energy projects. In addition to sage-grouse, the decision support monitoring may include surveys for other wildlife species, or vegetation response to reclamation activities. Either of these surveys may assist decision makers in the ongoing operation or mitigation actions associated with a particular project.

For greater detail on implementing the listed conservation actions or monitoring refer to *Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: a plan to maintain and enhance populations and habitat* and references therein (Hagen 2011).

Mitigation accounting–To assess the likely contribution of mitigation actions towards "no-net-loss" it is recommended that three key elements are considered: additionality, probability of success, and time lag to conservation maturity (Kiesecker et al. 2010). Additionality is defined as a mitigation action's new contribution to conservation in addition to existing values. Probability of success is defined as likelihood that a mitigation action will deliver expected conservation benefits. Time lag to conservation maturity is evaluated as the length of time for a mitigation action to deliver conservation at a maturity level (or ecological state) similar to that which was lost at the impact site (Kiesecker et al. 2010: 176). It is important to account for these key elements when developing habitat mitigation for sage-grouse or other fish and wildlife habitats. Thus, the area of impact calculated using the recommended techniques provides an opportunity for creating a minimum habitat "currency" to be exchanged in a mitigation type market-place.

Literature Cited:

Becker, J. M., C.A. Duberstein, J.D. Tagestad, and J.L. Downs. 2009. Sage-grouse and wind energy: biology, habits, and potential effects from development PNNL-18567. US Dept of Energy. Pacific Northwest National Laboratory, Richland, Washington.

Blickley, J. L. and G. L. Patricelli *in press*. Noise impacts on sage-grouse: a noise introduction experiment. Conservation Biology 00: 000-000.

Bureau of Land Management. 2010. West Butte Wind Power Right of Way: Final Environmental Impact Statement. Prineville District BLM, Prineville, OR.

Compton, B. and D. Mitchell. 2005. The sage-grouse of Emma Park- survival, production, and habitat use in relation to coalbed methane development. Utah Division of Wildlife Resources, Salt Lake City, UT.

Ellis, K. L. 1985. Effects of new transmission line on distribution and aerial predation of breeding male sage-grouse: final report. Deseret Generation and Transmission Cooperative. Sandy, UT.

Gaines, W. L., P. H. Singleton, and R. C. Ross. 2003. USDA Forest Service, General Technical Report PNW-GTR-586: Assessing the Cumulative Effects of Linear Recreation Routes on Wildlife Habitats on the Okanogan and Wenatchee National Forests. Pacific Northwest Research Station.

Hagen, C. A., J. C. Pitman, R. J. Robel, B. K. Sandercock, T. M. Loughin, and R. D. Applegate. 2011. Potential impacts of anthropogenic features on lesser prairie-chicken habitat use. Studies in Avian Biology 39: 63-76.

Hagen, C. A. 2011. Greater sage-grouse conservation assessment and strategy for Oregon: a plan to maintain and enhance populations of habitat. Oregon Department of Fish and Wildlife, Salem, USA.

Hagen, C. A. 2010. Impacts of energy development on prairie grouse ecology: a research synthesis. Transactions of North American Wildlife and Natural Resource Conference 75:96-103.

Hunt, J. L. 2004. Investigation into the decline of populations of lesser prairie-chickens in southeastern New Mexico. Dissertation. Auburn University, Auburn, Alabama.

Holloran, M. J. 2005. Greater sage-grouse (*Centrocercus urophasianus*) population response to natural gas field development in western Wyoming. Dissertation, University of Wyoming, Laramie, Wyoming.

Johnson, B. K., J. W. Kern, M. J. Wisdom. 2000. Resource selection and spatial separation of mule deer and elk during spring. Journal of Wildlife Management. 64(3): 685–697.

Johnson, D. H. M. J. Holloran, J. W. Connelly, S. E. Hanser, C. L. Amundson, and S. T. Knick. 2011. Influences of environmental and anthropogenic features on Greater Sage-Grouse populations, 1997-2007. Pp. 407-450 *in* S. T. Knick and J. W. Connelly. Greater Sage-Grouse: ecology and conservation of a landscape species and its habitat. Studies in Avian Biology 38. University of California Press, Berkeley, CA.

Kiesecker, J. M., H. E. Copeland, B. A. McKenney, A. Pocewicz, and K. E. Doherty. 2010. Energy by design: making mitigation work for conservation and development. Pages 159-181, in Energy Development and Widllife Conservation in Western North America (D. E. Naugle, editor.). Island Press, Washington DC.

Oregon Department of Fish and Wildlife. 2006. Oregon Conservation Strategy. Salem, USA

Oregon Department of Fish and Wildlife. 2009. Recommendations for greater sage-grouse habitat classification under Oregon Department of Fish and Wildlife fish and wildlife habitat mitigation policy. Unpublished report, Salem, USA.

Wisdom, M. J., C. W. Meinke, S. T. Knick, and M. A. Schroeder. 2011. Factors associated with the extirpation of sage-grouse. Pp. 451-474 *in* S. T. Knick and J. W. Connelly. Greater Sage-Grouse: ecology and conservation of a landscape species and its habitat. Studies in Avian Biology 38. University of California Press, Berkeley, CA.

Hypothetical Example of Habitat Mitigation Framework for Sage-Grouse Habitat

The following write-up demonstrates how mitigation recommendations would be implemented using guidance provided in the Sage-Grouse Conservation Strategy as well as application of the multi-scale approach of the Core Area framework. A hypothetical renewable energy project is used to illustrate this guidance.

Macro-siting
The first step is to identify where a potential project occurs with respect to Core Areas and Low Density Areas, and non-core sagebrush habitat (outside of Core and Low Density Areas: Fig. 1). Where project area overlaps with sage-grouse habitat within a Core Area, recommend avoiding impacts to those areas (Fig. 2).

Micro-siting
Assuming the recommendations for Core Area are followed, seek to further refine locations of renewable energy infrastructure based on noise impacts (Fig. 3). Sound propagation buffers that overlap with Core Area and are likely to impact sage-grouse habitat should assist in siting infrastructure such that it does not impact those habitats. This siting would likely require setbacks of infrastructure such that the sound propagation contours do not occur in Core Area sagebrush habitat (Fig. 3 and 5). However, a site level analysis is needed to verify habitat types occurring at the intersection of a Core Area and sound buffers, as there may be opportunities for siting near the Core Area boundary (Fig. 5).

Mitigation acre quantification
The intersection of Low Density, sound propagation contours, vegetation (i.e., sagebrush habitat in this example), and soils (i.e., assumed as 1 type for this example) GIS layers provide minimum estimate of acreage needed for sage-grouse habitat mitigation (Fig. 4, Table 1). Specifically, the Low Density and habitat data result in approximately 24,000 acres needed to mitigate for impacts to sage-grouse habitat (Table 1).

Caveats
This example only focuses on sage-grouse habitat needs as it pertains to sagebrush habitat in Core and Low Density Areas. There may be other species that require mitigation. Sagebrush habitats not in Core or Low Density areas may provide habitat for other sagebrush dependent species and serve as important linkages for sage-grouse movement. These habitats will be categorized under the Department's mitigation policy, but such sites will be evaluated on a case-by-case basis to determine appropriate classification.

Table 1. Summary of acres from hypothetical renewable energy project in Oregon.

Area of interest	Acres	Figure reference
Project Boundary Total	47,846	Fig 1
Project Boundary without Core Area	38,470	Fig 2
Hypothetical Sound Propagation Buffer	97,639	Fig 3
All habitat within Sound Buffer	55,867	Fig 3, 4
Low Density Mitigation	**24,146**	**Fig 4**

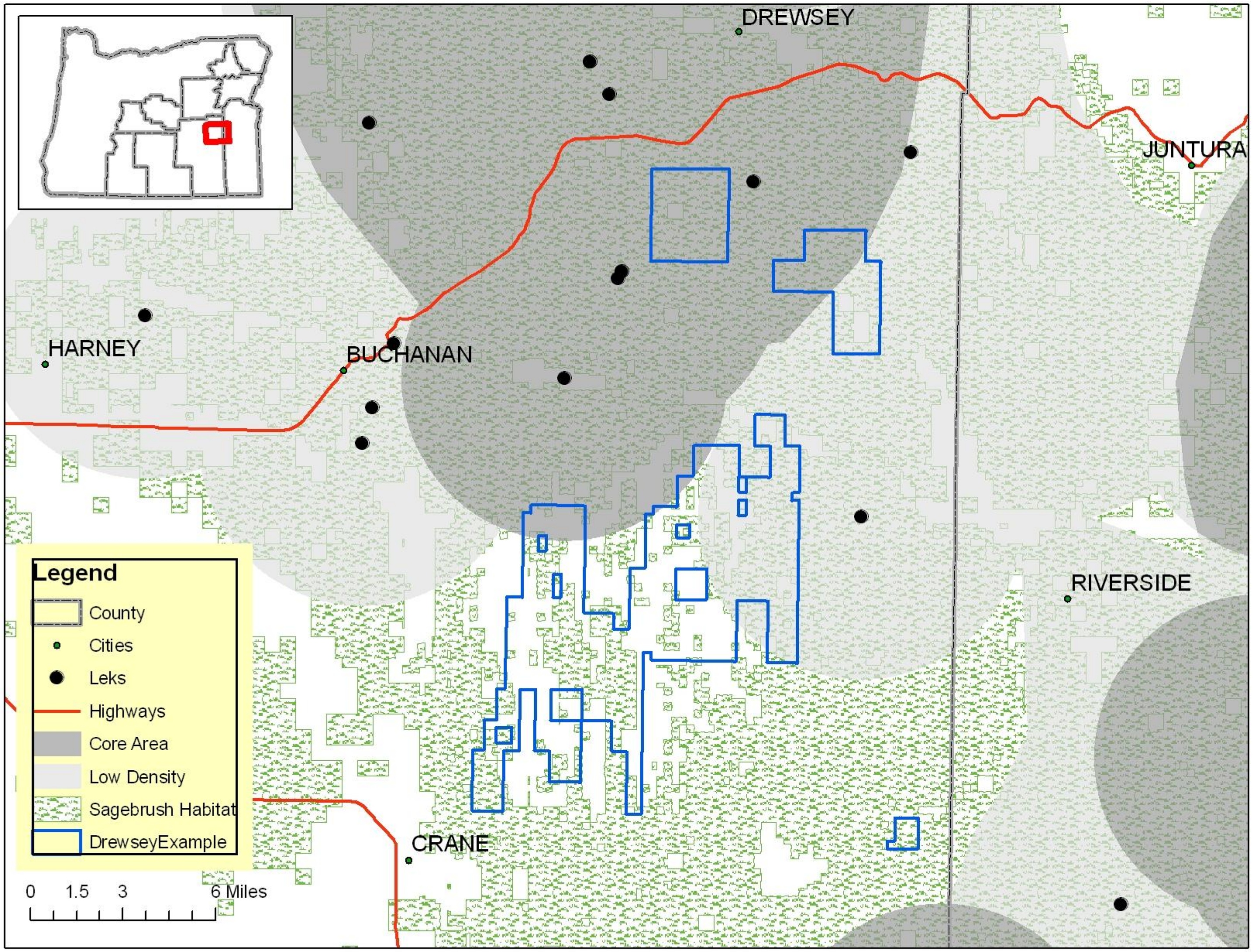

Figure 1. Hypothetical renewable energy project area in northeastern Harney County (blue outlined polygons). The project area occurs in Core Area, Low Density, and non-core sagebrush habitats.

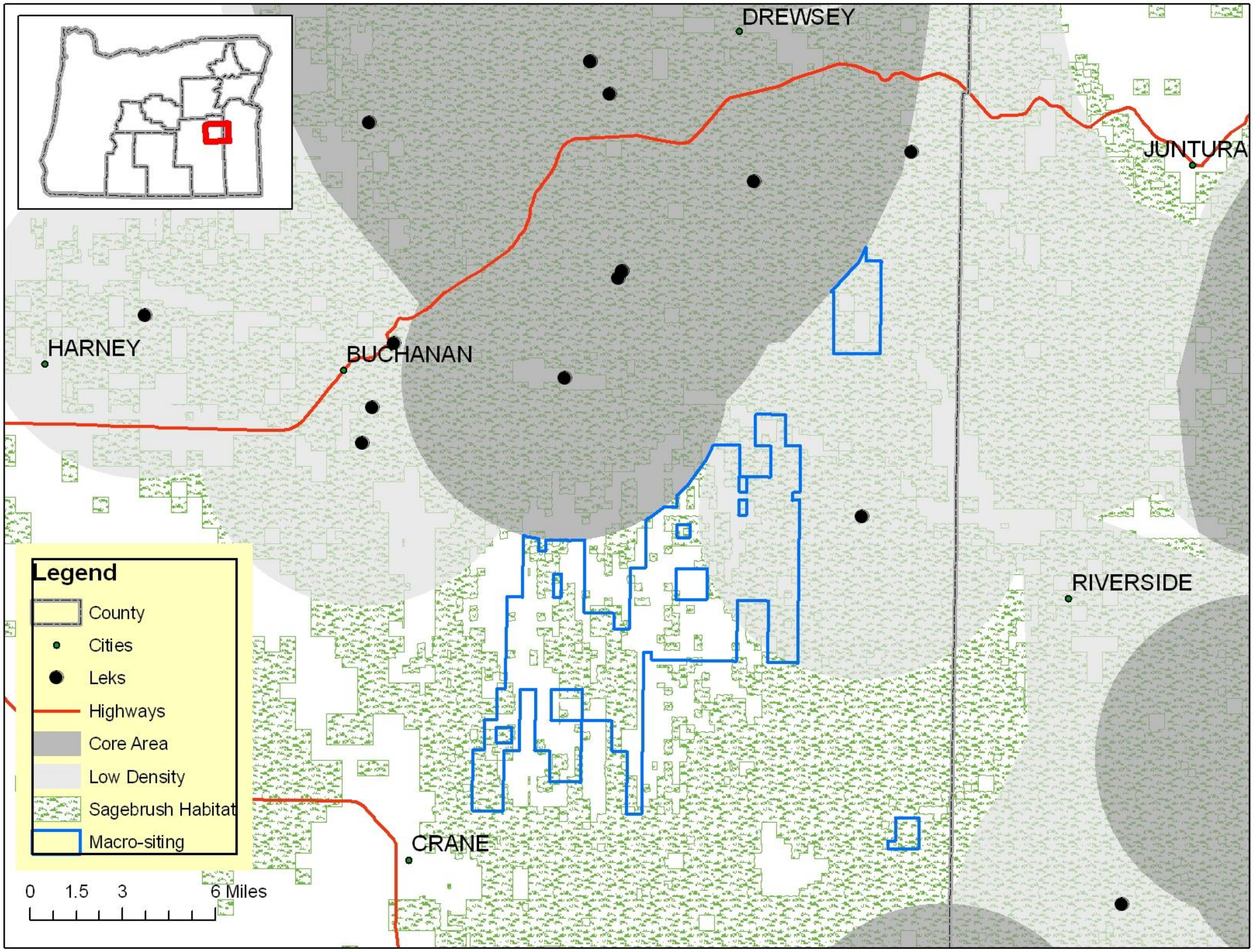

Figure 2. Hypothetical renewable energy project area in northeastern Harney County (blue outlined polygons). The project area that occurs in Core Area has been omitted per the potential recommendations of ODFW.

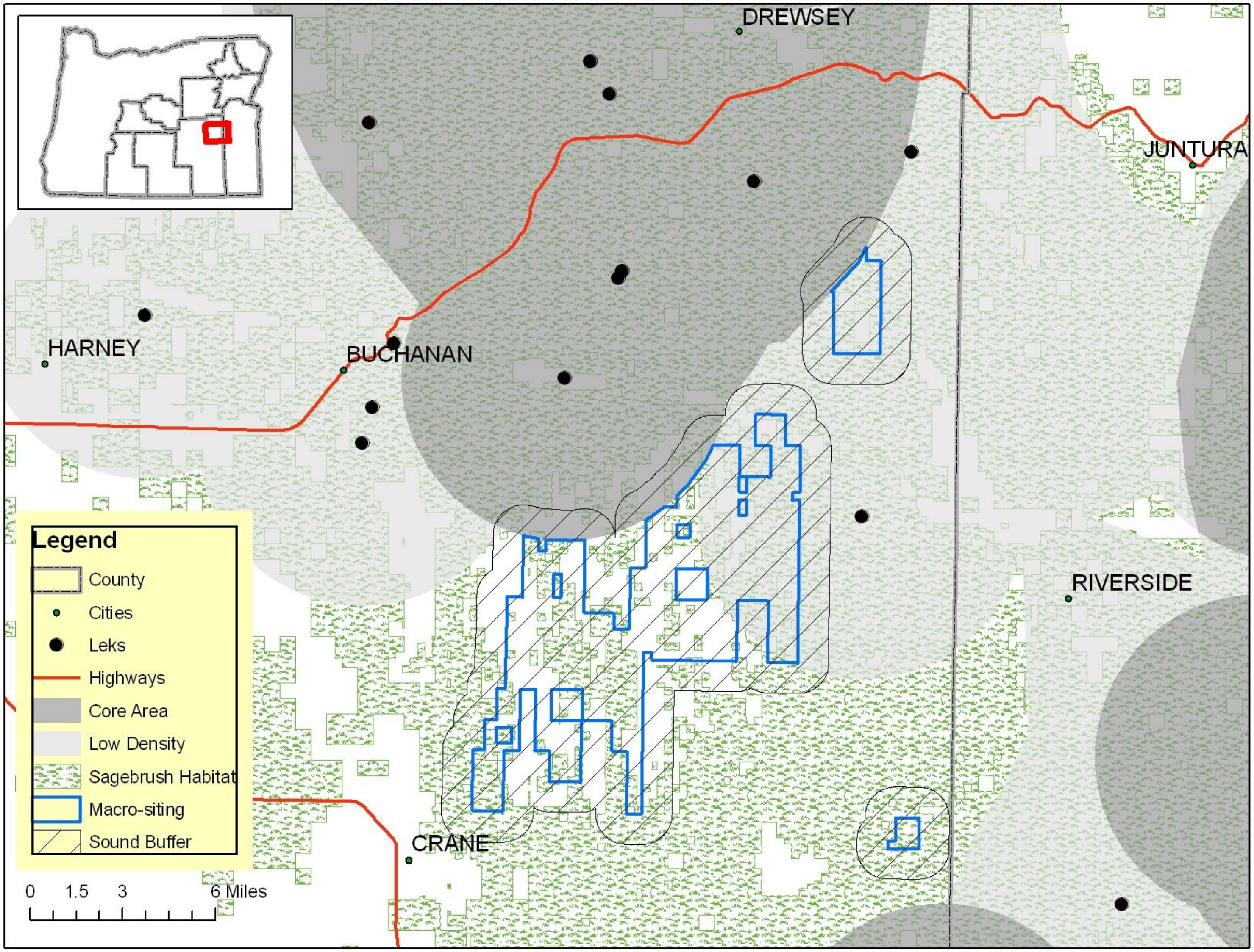

Figure 3. Hypothetical renewable energy project area in northeastern Harney County (blue outlined polygons). The project area has been buffered (cross-hatched) by 1 mile to portray how a sound propagation model may identify noise impacts of 40db(A) or louder.

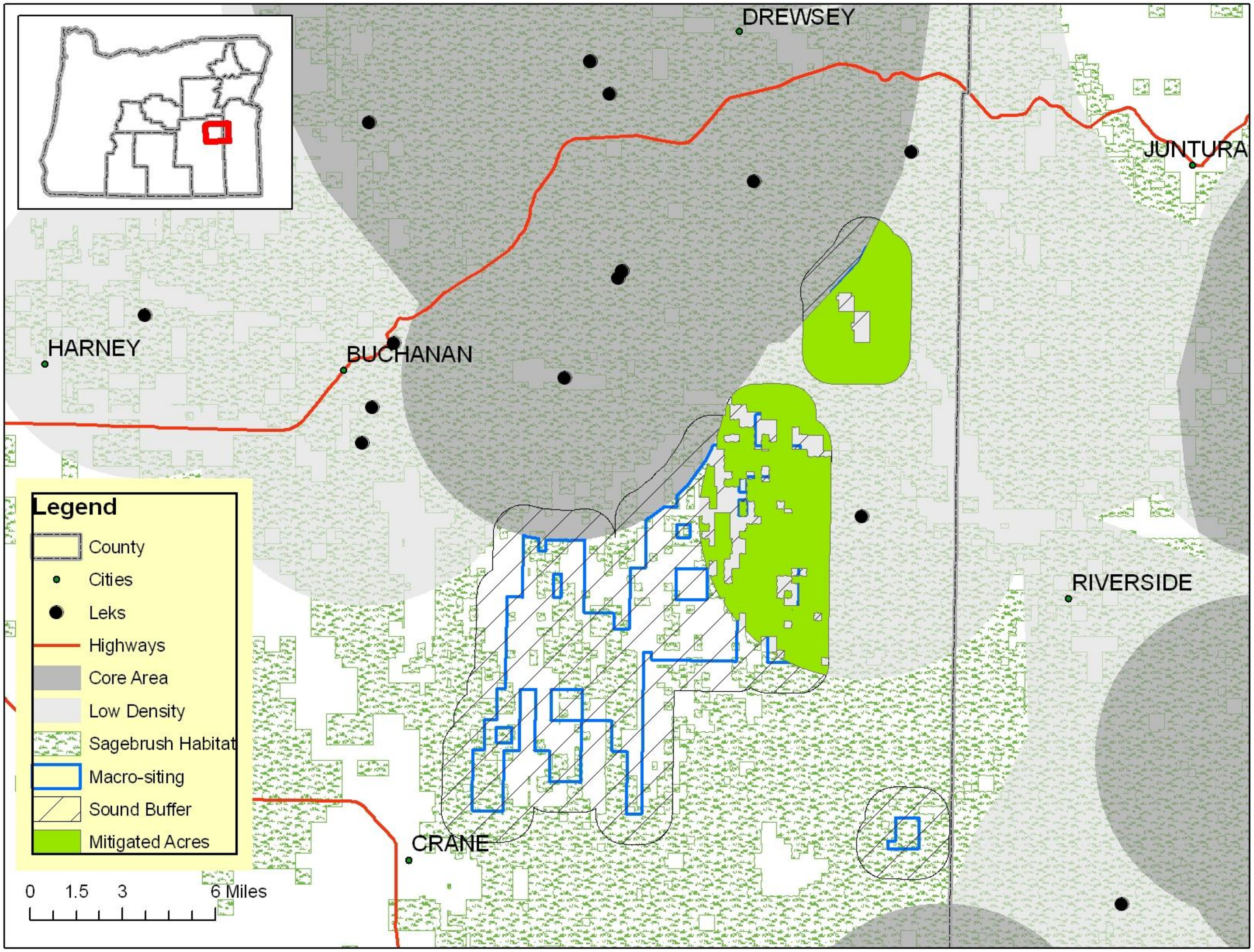

Figure 4. Hypothetical renewable energy project area in northeastern Harney County (blue outlined polygons). Area for which habitat mitigation acres would be quantified (bright green). Note non-sagebrush areas are not included in area used to quantify mitigation acres for sage-grouse.

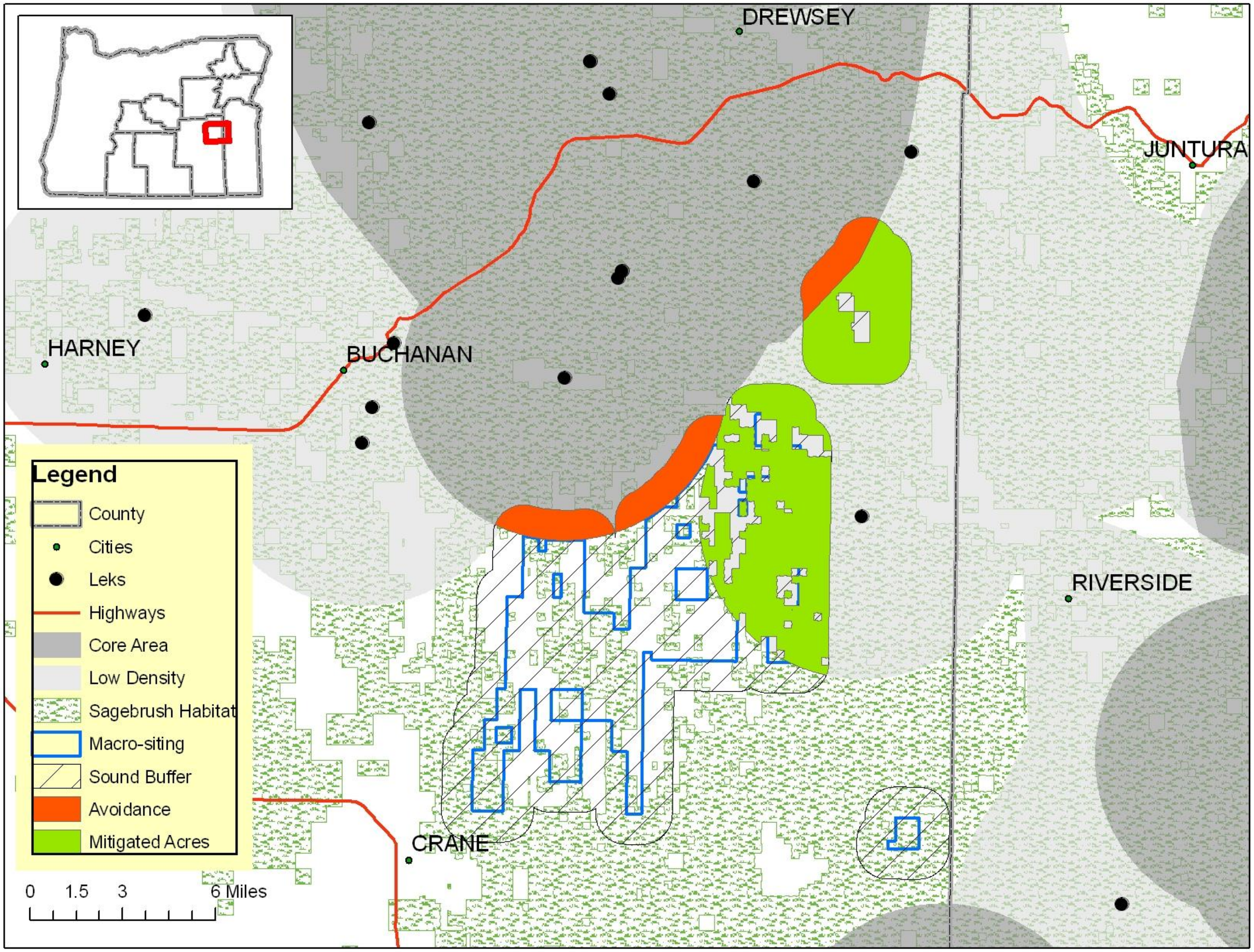

Figure 5. Hypothetical renewable energy project area in northeastern Harney County (blue outlined polygons). Area for which habitat mitigation acres would be quantified (bright green and stippled green), additional areas of potential avoidance (red polygons).