CONSIDERATIONS FOR NATURAL MINERAL LICKS USED BY MOOSE IN LAND USE PLANNING AND DEVELOPMENT

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ABSTRACT: Despite an increasing body of knowledge about the predictable use and functional role of naturally occurring mineral licks in the ecology of ungulates such as moose (*Alces alces*), no documents have been published that discuss the importance of implementing management guidelines aimed to protect these habitat features. We reviewed the literature on the biophysical attributes of mineral lick sites and their use by moose to illustrate the importance of licks and outline criteria that may serve to help in the development of guidelines to protect these land features. We canvassed the provinces and territories of Canada to ascertain whether any regulatory framework for identifying, classifying, and protecting mineral licks existed. Despite appeals for lick protection from several authors, few jurisdictions recognize mineral licks as a special habitat feature and none appear to base their guidelines for protecting licks on ecological principles. We also found no evidence for the existence of a set of standardized guidelines that can be used by planners and managers to ensure the protection of licks. We incorporated ecological and biophysical aspects of mineral licks into a field checklist to identify and classify mineral licks used by moose, and developed a preliminary draft of a management procedure to enable their protection.

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Mineral licks are unique and important habitat features important in the ecology of moose (*Alces alces*) and other ungulates (Ayeni 1971, Kreulen 1985, Klaus and Schmid 1998). Unlike dry earth exposures and rock face mineral licks that are used commonly by goats (*Oreamnos* sp.) and sheep (*Ovis* spp.), mineral licks used by moose are generally characterized by well worn trails leading to wet muddy springs or seepage areas that contain dense track concentrations (Tankersley and Gasaway 1983, Jones and Hanson 1985). These areas, also referred to as muck licks, are also used by deer (*Odocoileus* spp.) and elk (*Cervus* sp.) and are thought to be extremely sensitive to impacts from land development activities (Weeks and Kirkpatrick 1976, Reger 1987, Bechtold 1996, Dormaar and Walker 1996). However, standardized guidelines for field identification, rating the ecological importance of licks, and establishing protective measures for these sites remain uncirculated.

We reviewed the literature to summarize use patterns of mineral licks by moose and to ascertain the importance of mineral licks in the ecology of moose. We also reviewed the works of authors appealing for lick protection and canvassed the provinces and territories of Canada to determine the current policies and guidelines used for

protecting mineral licks. Our objectives were to determine if such a framework existed and identify those criteria required to construct a rating system to facilitate field identification and classification of mineral licks for purposes of protection.

ECOLOGICAL ROLE OF LICKS

Much speculation exists as to why moose and other animals use mineral licks (Kreulen 1985, Dormaar and Walker 1996, Klaus and Schmid 1998). It is believed that animals visit licks for, among other things, mineral supplementation, soils to aid digestion, and water and social gathering (Fraser and Hristienko 1981, Jones and Hanson 1985, Risenhoover and Peterson 1986, Couturier and Barrette 1988, Heimer 1988). Licks are used by moose predominantly from dusk until dawn (Fraser and Reardon 1980, Tankersley and Gasaway 1983, Couturier and Barrette 1988), most often in late spring (Fraser and Hristienko 1981, Tankersley and Gasaway 1983, Couturier and Barrette 1988, Filus 2002) and mid-winter (Rea, Hodder and Child, unpublished data), and to lesser degrees at other times of the year.

Moose use mineral licks in a predictable pattern, obtaining resources from the soil and water of these features. Mineral licks and other sources of concentrated sodium may influence the spatial and temporal structure of moose populations (Panichev et al. 2002). The health of some moose herds has been reported to be dependent on the presence of and regular access to mineral licks (Best et al. 1977). Since land management activities may disrupt the integrity of mineral licks and possibly impact ungulate populations (Weeks and Kirkpatrick 1976, Dormaar and Walker 1996), several authors have recommended protective measures for licks be integrated into land use policy (Best et al. 1977, Tankersley and Gasaway 1983, Reger 1987, Bechtold 1996, Dormaar and Walker 1996, Klaus and Schmid 1998).

REGULATORY STATUS IN CANADA

No jurisdictions are cited in the literature as having management guidelines to safeguard mineral licks from land development activities. Despite a lack of such discussion in the literature, 4 of 13 jurisdictions that we contacted across Canada recognize the importance of natural licks and have drafted guidelines to ensure mineral licks are considered in land management plans.

Alberta recognizes mineral licks and provides management suggestions on how to treat these features. While emphasizing that a buffer zone is required, it is recommended that it be one "sight distance" (Government of Alberta 1994). The definition of a site distance is subjective and open to interpretation, making field application difficult.

British Columbia identifies a "mineral lick" or "wallow" as a wildlife habitat feature. Such features are protected to different degrees on a regional basis at the discretion of the local environmental authorities (Government of British Columbia 2004).

Ontario recommends a minimum buffer of 120 m around mineral licks for moose with the recognition that some development and/or extraction activities (i.e., forest harvesting) may occur under special circumstances within the buffer area. Unlike other jurisdictions, Ontario recommends a site-specific approach to establishing buffers around a lick site that considers the forest stand and other landscape characteristics (e.g., local hydrology and topography). This includes designing the shape and extent of the buffer zone to ensure the integrity of the site and safe access for moose (Ontario Ministry of Natural Resources 1988).

Quebec legislation defines a lick narrowly as a swamp, spring, or body of water

that contains mineral salts in concentrations greater than 3 parts per million of potassium and greater than 75 parts per million of sodium. Management guidelines dictate that these sites, regardless of site specific attributes, retain a 100 m wide undeveloped reserve zone around the lick (Government of Quebec 2004).

No other jurisdictions in Canada appear to have formal management guidelines for considering mineral licks, although there may be uncirculated policies and procedures that exist for identification and protection of these sites. Some jurisdictions have regulations for managing "habitat features" but are only legislated into management guidelines if the species(s) using that feature is threatened or endangered as in Saskatchewan (Government of Saskatchewan 2003), or special management recommendations are made on a case by case basis as in the Yukon Territory (Yukon Department of Renewable Resources 1996) and Nova Scotia (Anthony P. Duke, Manager Wildlife Resources, Nova Scotia Department of Natural Resources, personal communication). As a result, there appears to be no set of standardized, easy-to-implement guidelines available for resource managers in Canada or elsewhere to use that would be helpful in delineating considerations for mineral licks in land use planning and development activities.

CLASSIFYING MINERAL LICKS

Although what constitutes a mineral lick is understood, a comprehensive understanding of use by moose and a procedure to rank the importance of these areas to moose is less clear. Assessing certain attributes in the field should indicate whether a site is a functional mineral lick. The same attributes could also be used to determine and rank the relative importance of the site for moose. A site with well worn trails, denser track concentrations, and a more extensive lick area, for example, is likely more important to animals than a small seepage area containing few tracks and an inconspicuous trail network.

One method that could be used to identify and classify mineral licks could employ identification of site attributes. A field checklist could be used to identify and describe site attributes commonly associated with mineral licks used by moose (Table 1). This procedure would include both quantitative and qualitative measurements, but would not be too complicated, onerous, or time-consuming for field crews. Importantly, certain of these attributes could also be used to assess the impact of any activity.

MANAGEMENT GUIDELINES

There are at least three aspects to consider when managing or regulating dis-

Table 1. Key site attributes for identifying, and developing a site identification/classification system for wet mineral licks used by moose. The degree to which site attributes are evident may vary seasonally (see text).

Site Attribute	Reference
Wet muddy area or seepage	Dormaar and Walker 1996
Animal sightings or sign (e.g., pellets, hedged browse, tree rubs, muddy vegetation, bed sites)	Fraser and Hristienko 1981, Jones and Hanson 1985
Dense track concentrations	Tankersley and Gasaway 1983, Jones and Hanson 1985
Exposed mineral soils with clays or organic materials	Chamberlin et al. 1977, Jones and Hanson 1985, Bechtold 1996
Trail convergence	Fraser and Hristienko 1981, Tankersley and Gasaway 1983, Jones and Hanson 1985
Trail use (i.e., wear or compaction)	Fraser and Hristienko 1981, Tankersley and Gasaway 1983
Evidence of human activities (e.g., bullet casings, hunting blinds, animal remains, etc.)	Observations by authors

turbance around mineral licks: (1) protection of the mineral lick site; (2) maintaining the integrity and function of the hydrological system feeding the lick; and (3) minimizing disturbance in surrounding areas during peak visitation times. Rating the importance of the mineral lick for moose is the first in a series of steps that allows for its consideration in land development planning. How to best protect the site and maintain its integrity depends on several factors including the sensitivity of all species using the lick, the biophysical factors of the site, and the type of development planned for the area.

Correctly identifying all species using the lick is important since misidentifying or neglecting to identify threatened species will influence protective measures necessary to mitigate disturbance impacts (Reger 1987). Reserve zones (buffers) or the like could be used to mitigate disturbance to licks and should be assigned in accordance with the importance of the lick to the wildlife species using the lick, the intensity of use, and the occurrence of similar features across the landscape. Lick protection guidelines should also encompass lick site trail networks, hydrological features, nearby thermal and security cover, and adjacent foraging sites (Wiles and Weeks 1986).

Although the relative importance of mineral licks to moose is known to wildlife managers, their value as a land feature may be less apparent to land use planners and developers. Therefore, conveying the ecological importance of mineral licks to land managers is key to developing and implementing guidelines for protecting mineral licks. Specifically, integrating ecological principles within a management framework (Table 2) could provide direction and flexibility when prescribing protective measures for mineral licks. For example, development could occur in late fall or early spring when moose activity at mineral licks is minimal (Tankersley and Gasaway 1983, Couturier and Barrette 1988, Fraser and Hristienko 1981, Rea, Hodder and Child, unpublished data) and be carried out during mid-day hours since moose use mineral licks predominantly at night (Fraser and Reardon 1980, Tankersley and Gasaway 1983, Couturier and Barrette 1988, Silverberg et al. 2002). Such strategies could reduce stress and unneeded energy expenditures for moose that are sensitive to disturbance (Couturier and Barrette 1988, Silverberg et al. 2002), especially during the winter months (Colescott and Gillingham 1998). An integrated management approach of this type would help ensure that the integrity of the feature is protected, that the ecological value of the site is maintained, and that land development proceeds in an appropriate fashion.

The final step in this integrated management process is to monitor the impact of prescriptions and subsequent development activity on the biophysical attributes of the

Table 2. Management considerations related to the ecological characteristics and role of mineral licks used by moose.

Ecology	Management
Seasonal use	Avoid seasonal activity peaks (documentation/observations)
Daily use	Avoid peaks in daily use (observations)
Tolerance to disturbance	Gauge habituation to human activity (observations)
Trail system	Protect: machine free zones should include habitat/trails
Soils use and biophysical aspects of lick function	Test soils for susceptibility to disturbance, compaction, and erosion.
Water sources of lick	Protect: earth moving activity should not disrupt hydrological flow of lick
Vegetation cover requirements	Maintain cover and vegetation proximate to lick

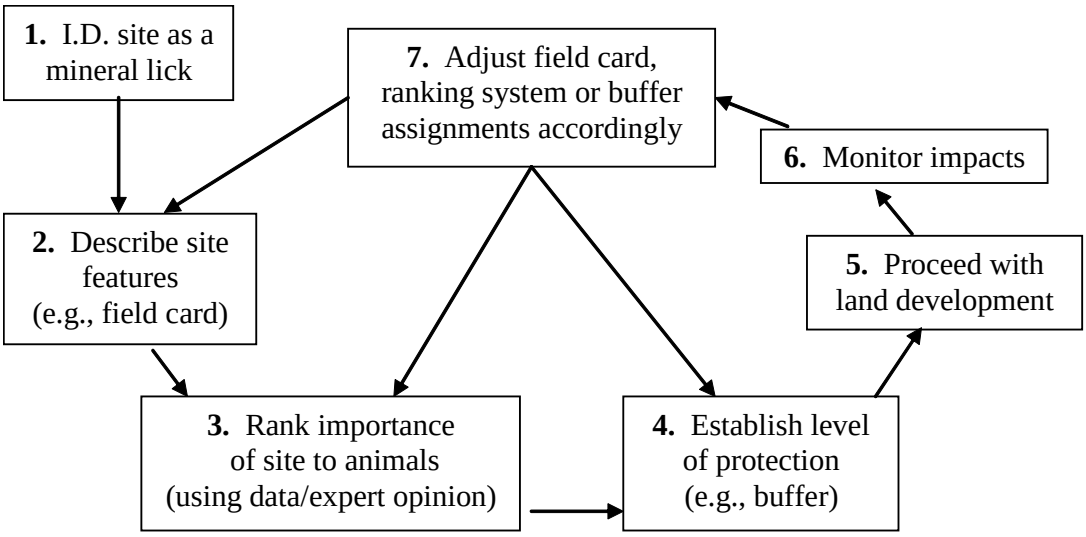

Fig. 1. Process recommended for determining and assigning the appropriate level of protection for mineral licks threatened by land development activity.

site, site use, and activity patterns of moose. Monitoring and assessment are imperative in the continual process of developing and modifying guidelines, and allow for feedback during the process (Fig. 1). Both site-specific and regional management approaches will benefit from adequate assessment of management prescriptions developed to protect mineral licks.

SUMMARY

We do not fully understand the importance of mineral licks to moose or how land development may impact mineral lick function or influence moose activity patterns at these features. Our findings indicate that a set of standardized guidelines for protecting licks is currently needed. Systematic identification and classification of mineral licks using a field checklist would facilitate the development of an objective field procedure. Broad implementation and testing at several sites would help justify its application. Additionally, a set of draft procedures by which managers can start to consider and incorporate these data into management plans for prescribing appropriate levels of protection for mineral licks is presented. Finally, the adoption of an adaptive management style that allows for a fine-tuning of the management framework in response to monitoring and site assessments is advocated.

We recommend that research focus on monitoring moose use of licks and measuring biophysical attributes at lick sites throughout the range of moose. These data could then be used to develop a standardized set of guidelines to help planners and managers implement needed mitigation measures for licks in areas where development is proposed. Until such a framework is developed and our understanding of lick function is more complete, a conservative approach, which protects the integrity and security of lick sites for animals from human activities and development, is presently advisable (Bechtold 1996, Dormaar and Walker 1996).

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