Université du Québec en Abitibi-Témiscamingue

ACTIVITÉS ANTHROPIQUES ET UTILISATION AUTOCHTONE DES MILIEUX HUMIDES, PARTICULIÈREMENT POUR LA CHASSE À L'ORIGNAL

Mémoire
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Par
Eliane Grant

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AVANT-PROPOS

Le mémoire est présenté sous forme d'article. Ce dernier sera soumis à une revue scientifique avec évaluation par les pairs et aura comme auteur·e·s, « Eliane Grant, Hugo Asselin et Nicole Fenton ». Je suis la principale responsable de l'étude, de la collecte des données, de leur analyse et de la rédaction de l'article. Ma direction et ma codirection de recherche ont contribué à la conception de l'étude et m'ont assistée dans l'interprétation des résultats. Elles ont aussi révisé de manière critique et constructive le contenu de l'article.

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RÉSUMÉ

Le développement industriel et l'exploitation des ressources naturelles entraînent des changements dans le paysage d'Eeyou Istchee Baie-James, fortement composé en forte proportion de milieux humides. Des inquiétudes ayant été soulevée par les Premières Nations de la région, l'objectif de cette étude était de documenter leur utilisation des milieux humides et d'évaluer les effets des perturbations anthropiques sur les activités traditionnelles dans ces milieux, telles que la chasse à l'orignal (*Alces americanus*). Un modèle exploratoire séquentiel a été utilisé pour examiner qualitativement le lien culturel avec les milieux humides pour les Eeyouch (Cris) de Mistissini et les Abitibiwinnik (Anicinapek/Algonquins) de Pikogan, ainsi que pour développer une méthode quantitative et non invasive d'évaluation de l'effet des perturbations anthropiques sur la santé des orignaux basée sur la concentration de cortisol pilaire (indicateur de stress).

Dans la phase qualitative, 12 entrevues semi-dirigées ont été conduites avec des chasseurs eeyouch et abitibiwinnik utilisant le territoire d'Eeyou Istchee Baie-James. Ils ont décrit unanimement les milieux humides comme étant d'abord des habitats fauniques, donc étant indirectement essentiels à la culture. Certains ont décrit les milieux humides comme un élément central au maintien de l'équilibre du territoire. Selon eux, la fréquence d'utilisation et la force du lien au territoire sont modulées par le taux de perturbation et par l'occupation principale des participants. Un niveau élevé de perturbation et la pratique occasionnelle d'activités culturelles effritent l'importance du lien au territoire et aux milieux humides.

Dans la phase quantitative, 38 orignaux ont été échantillonnés dans Eeyou Istchee Baie-James et en Abitibi-Témiscamingue pour évaluer, par une analyse de régression, les effets relatifs de différentes perturbations sur les niveaux de cortisol dans les poils. En raison de l'absence de perturbations anthropiques importantes dans la zone d'étude, et vu la relative bonne santé des orignaux échantillonnés, il n'a pas été possible d'évaluer l'effet des perturbations sur le niveau de cortisol (stress) des orignaux. En revanche, la présence de tique d'hiver (*Dermacentor albipictus*) était associée à des niveaux significativement plus élevés.

Les résultats mettent en évidence l'importance des milieux humides pour les Autochtones, souvent négligés par les industries. Cela souligne la nécessité de prendre en compte les intérêts des communautés autochtones dans les projets de développement. De plus, l'étude a généré des données de référence de concentration de cortisol dans les poils d'orignaux, qui pourront être utilisées pour développer un outil de suivi non invasif des populations. Ces données sont précieuses pour la conservation de la faune et la gestion des écosystèmes. En somme, cette étude contribue à la compréhension des relations entre les Autochtones, les milieux humides et la faune.

Mots clés : Eeyou Istchee Baie-James, milieux humides, Eeyou, Abitibiwinni, orignal, chasse, cortisol

Keywords: Eeyou Istchee James Bay, wetlands, Eeyou, Abitibiwinni, moose, hunting, cortisol

INTRODUCTION GÉNÉRALE

Problématique. Le Nord-du-Québec est exploité pour ses nombreuses ressources naturelles; des ressources qui sont nécessaires pour le développement de la société, mais dont l'exploitation ne se fait pas sans perturbations du territoire (Bélisle et Asselin, 2021; Lathoud, 2005; Whiteman, 2016), ni sans conséquences pour les populations autochtones (Asselin, 2011) et la biodiversité (Mantyka-Pringle *et al.*, 2017). Un exemple de ces conséquences est la construction de grands projets hydroélectriques, en plus de l'exploitation minière et forestière, qui a entraîné un développement rapide et important du réseau routier sur le territoire. Les modifications du paysage dues à ces activités anthropiques ont un effet sur l'environnement (Kneeshaw *et al.*, 2010), notamment sur les milieux humides (Finlayson *et al.*, 2019; Whiteman, 2016).

La forêt boréale canadienne contient environ 25 % des milieux humides existant encore au monde (Hawkings, 2009). C'est donc dire que l'augmentation des perturbations anthropiques en forêt boréale canadienne affecte les milieux humides (Naiman et Turner, 2000; Poulin *et al.*, 2016). En Eeyou Istchee Baie-James, les milieux humides occupent une grande place dans le paysage (Natural Resources Canada, 2019) et font donc partie intégrante de la culture des Premières Nations (Beckford *et al.*, 2010; Chasmer *et al.*, 2020; Shields et Guevara-Salamanca, 2023). Par conséquent, les changements environnementaux qui affectent les milieux humides affectent également les utilisateurs du territoire, notamment les Nations Eeyou et Anicinape.

Les Autochtones utilisent le territoire afin de maintenir leur mode de vie traditionnel (Asselin, 2015; Berkes *et al.*, 1995). Par exemple, la chasse est encore très présente et elle est pratiquée par plusieurs membres des communautés eeyouch et anicinapek. Le gibier le plus abondamment chassé par les communautés dans la région à l'étude est l'orignal (*Alces americanus*). Des inquiétudes concernant la qualité de la viande de gibier récoltée à proximité des infrastructures industrielles ont été formulées par les chasseurs eeyouch (Tallymen de Nemaska, communication personnelle, 24 mai 2018), comme en territoire anicinape plus au sud (Bordeleau *et al.*, 2016).

La présente étude s'intéresse aux effets des perturbations anthropiques – particulièrement de l'industrie minière puisque les régions du Nord-du Québec et de l'Abitibi-Témiscamingue détiennent près de 50% de la valeur totale des livraisons minérales du Québec (Institut de la statistique du Québec, 2021) – sur l'utilisation des milieux humides par les Eeyouch de Mistissini, ainsi que par les Abitibiwinnik de Pikogan, plus particulièrement en ce qui concerne la chasse à l'orignal.

État des connaissances. ***Milieux humides en Eeyou Istchee.*** Par définition, « [les] milieux humides et hydriques [sont] des lieux d'origine naturelle ou anthropique qui se distinguent par la présence d'eau de façon permanente ou temporaire, eau qui peut être diffuse, occuper un lit ou encore saturer le sol et dont l'état est stagnant ou en mouvement. Lorsque l'eau est en mouvement, elle peut s'écouler avec un débit régulier ou intermittent » (Lachance *et al.*, 2021). Au Québec, on distingue quatre types de milieux humides : les eaux peu profondes (moins de 2 m), les marais, les marécages et les tourbières (ombrotrophes et minérotrophes) (Pellerin et Poulin, 2013; Warner et Rubec, 1997). Les milieux humides sont des écosystèmes qui font partie intégrante du cycle hydrologique. Ils ont des fonctions importantes telles qu'une forte productivité biologique, la fourniture d'habitats pour la faune et la flore terrestres et aquatiques, la filtration des polluants et des sédiments en suspension dans l'eau, et en jouant le rôle de régulateurs naturels en tant que zone tampon, en retenant les surplus d'eau, diminuant ainsi les risques d'inondation et d'érosion des rives (Greb *et al.*, 2006). Au Canada, les milieux humides couvrent environ 14 % du territoire du pays (Hawkings, 2009; Warner et Rubec, 1997). Au Québec, c'est 12,5 % de la province qui est recouvert de milieux humides, dont 85% sont des tourbières (Pellerin et Poulin, 2013). Les régions d'Eeyou Istchee Baie-James, de la Côte-Nord et du bassin versant de la rivière George sont celles où les milieux humides sont les plus abondants au Québec (Ménard *et al.*, 2013; Pellerin et Poulin, 2013).

Le manque de connaissances sur les utilisations et les savoirs autochtones concernant les milieux humides est un sujet qui préoccupe la communauté scientifique (Chasmer *et al.*, 2020; Speller et Forbes, 2022). Il est donc essentiel de poursuivre les recherches et de collaborer avec les communautés autochtones pour combler ce manque de connaissances et ainsi mieux comprendre les milieux humides (Alexander *et al.*, 2021; Chasmer *et al.*, 2020). En combinant les savoirs autochtones et scientifiques, il est possible de trouver des solutions durables pour préserver les écosystèmes (Bélisle *et al.*, 2022; Ezenweke et Nwachukwu, 2023).

Conséquences du développement anthropique pour les Autochtones. Les « savoirs écologiques traditionnels » (SET) sont transmis par les histoires au fil des générations et permettent une utilisation durable du territoire (Asselin, 2015; Ezenweke et Nwachukwu, 2023). Les SET sont un ensemble de connaissances, de pratiques et de croyances sur les relations entre les êtres vivants (incluant les humains) et leur environnement qui sont enracinées dans des coutumes, mais qui ont une capacité d'adaptation et de transformation dans le temps (Berkes, 2008). Les SET sont considérés inséparables du territoire, ce qui représente une différence majeure entre le point de vue des Autochtones et des non-Autochtones (Blaser *et al.*, 2004). Le terme « territoire » n'est pas non plus limité à l'environnement physique, mais représente plutôt une fusion des composantes physiques, biologiques et spirituelles (Blaser *et al.*, 2004; Cloud et Redvers, 2023). Les Eeyouch et les Anicinapek ne sont pas seulement des habitants du territoire, ils se considèrent comme faisant partie intégrante du milieu qu'ils occupent (Berkes, Fikret et Davidson-Hunt, 2006; Berkes, Fikret *et al.*, 1998; Cloud et Redvers, 2023; Salmón, 2000). D'ailleurs, les récits autochtones sont fortement inspirés par les expériences des chasseurs et autres utilisateurs du territoire, ainsi que par la composition du paysage. Les noms de lieux connus et utilisés par les personnes qui vivent sur un territoire particulier pendant de nombreuses années couvrent toutes les caractéristiques du paysage, et beaucoup sont liés à des histoires sur la façon dont le nom a été donné ou qui rappellent des personnes, des événements ou des associations. On observe ce phénomène chez les Eeyouch (Berkes, Fickret *et al.*, 1995; Blaser *et al.*, 2004; Huberman, 2022) et les Anicinapek (Davidson-Hunt et Berkes, 2003; Tobias et Richmond, 2014). Certaines personnes continuent de pratiquer un mode de vie traditionnel et dépendent des forêts pour leur alimentation (e.g., poissons, bleuets, canneberges, sauvagine), leurs produits médicinaux et leurs moyens de subsistance (e.g., bois d'œuvre). Cependant, la poursuite de ce mode de vie traditionnel est menacée par le développement anthropique.

L'étendue des milieux humides diminue en raison de leur conversion en terres agricoles ou en développements urbains et industriels (Coleman *et al.*, 2008; Finlayson *et al.*, 2019). Par exemple, selon Rochefort (2011), plus de 1 270 km^2 de tourbières ont été perturbés par des activités liées à la production d'hydro-électricité dans les secteurs des rivières La Grande, Eastmain, Sainte-Marguerite, Toulnustuc et Romaine. Il s'agit surtout de tourbières ennoyées ou affectées par des activités de déviation de cours d'eau (90 % des pertes) et de sites touchés par des emprises de lignes de transport d'électricité. Les données sur les activités de production d'hydro-électricité sont incomplètes, ne portant pas sur les autres rivières affectées. Les activités sylvicoles auraient pour leur part affecté au moins 1 000 km^2 de tourbières depuis 1986, surtout dans la région des Basses-terres de l'Abitibi. Il ressort de ces estimations qu'un minimum de 3 733 km^2 de tourbières auraient été perturbés au Québec dans les 50 dernières années (Rochefort *et al.*, 2011). Ce bilan n'inclut toutefois pas les effets des activités minières, qui abondent dans les régions de l'Abitibi-Témiscamingue et du Nord-du-Québec.

À partir de la fin des années 1960 que les compagnies hydro-électriques, forestières, et minières ont montré un intérêt grandissant pour le territoire du nord du Québec. Le développement hydro-électrique a été le premier grand projet d'exploitation industrielle en Eeyou Istchee Baie-James. Les conséquences environnementales du projet de la Baie-James I sont considérables. La construction des barrages a créé cinq réservoirs hydroélectriques couvrant plus de 10 000 km^2 (Berkes, 1990; Desbiens, 2007). Sous ces zones inondées se trouvent des territoires de chasse, des habitats naturels pour la faune et la flore, des routes migratrices pour le caribou et également des sites culturels et des sépultures (Blaser *et al.*, 2004; Huberman, 2022). Les rampes d'accès pour les bateaux des pêcheurs sont devenues impraticables puisque les arbres inondés empêchent la mise à l'eau. On remarque également une augmentation de la méthylation du mercure dans les réservoirs due à la décomposition des matières organiques, ayant comme résultat l'augmentation de la contamination au mercure des poissons et des Autochtones les consommant (Berkes, Fikret, 1990; Blaser *et al.*, 2004; Moriarity *et al.*, 2020; Schoen *et al.*, 2005).

L'industrie forestière fait également pression sur les ressources du territoire. Déjà, en 1993, plusieurs territoires de chasse eeyouch avaient été coupés à plus de 40%, certains à 80% (Lathoud, 2005). Le même phénomène a été noté en territoire anicinape, par exemple à Kitcisakik, dont plus de 60% du territoire a été coupé entre les années 1970 et 2000 (Saint-Arnaud *et al.*, 2009). Afin de soutenir le développement des divers projets d'exploitation, la construction de routes permanentes s'est répandue sur le territoire. Ceci a permis d'établir un lien entre les communautés et les villes plus au sud, mais également un accès plus facile aux territoires de chasse et de pêche traditionnels aux non-Autochtones, ce qui a augmenté l'occurrence de conflits (Kneeshaw *et al.*, 2010; McCutcheon, 1992). Depuis les années 1980, la chasse et la pêche sportives se pratiquent de manière intensive sur le territoire de Eeyou Istchee Baie-James. Les activités liées à la coupe et à la chasse sportive ont de nombreuses conséquences : destruction des habitats fauniques, retrait des arbres et de la végétation, déplacement et dégradation du sol, perturbation du drainage naturel, des barrages de castor, des lieux de frai et de migration des poissons, surexploitation du lièvre et de la perdrix, et déplacement du gibier (Lathoud, 2005).

Le développement de l'industrie minière au Québec nordique a connu plusieurs phases au cours du siècle dernier. Les premiers gisements ont été découverts grâce à des méthodes de prospection en surface. Cependant, l'avènement de la géophysique aéroportée dans les années 1950-60, a permis la découverte de gisements cachés, tels que les sulfures massifs de zinc et de cuivre dans les régions de Matagami et de Joutel (Ministère des Ressources Naturelles et des Forêts, 2021). Le secteur de Chapais-Chibougamau a également connu un développement important dans les années 1970. Au cours des dernières décennies, la compréhension de la formation et de la répartition des gisements a augmenté, ce qui a permis l'exploration à des profondeurs plus importantes.

L'intégration harmonieuse des projets miniers dans leur environnement est désormais une condition requise par les législateurs (Horowitz *et al.*, 2018; Thériault *et al.*, 2016), ce qui se traduit notamment par de la compensation (Bois-Charlebois, 2018). Il est également essentiel de prendre en compte les valeurs culturelles des Premières Nations dans le contexte d'exploitation minière (Horowitz *et al.*, 2018) et dans les pratiques de restauration des sites miniers (Kemp *et al.*, 2023). Une telle sensibilité culturelle permet une meilleure harmonie entre le développement minier et les communautés autochtones, favorisant ainsi une approche plus durable et respectueuse de l'environnement (Gauthier et Vanthuyne, 2022).

Les perturbations anthropiques affectent les communautés autochtones et les espèces dont elles dépendent pour la pratique d'activités culturelles et de subsistance (Thomas *et al.*, 2023). Pour plusieurs Autochtones, leur identité et leurs valeurs culturelles sont associées à leur mode de vie traditionnel basé, entre autres, sur la chasse et la pêche (Power, 2008). Dans les territoires de chasse familiaux qui ont été inondés ou affectés par l'exploitation forestière ou minière, la transmission des savoirs et des valeurs est plus difficile, voire impossible. La pratique des activités culturelles et les SET deviennent alors des souvenirs douloureux quand le territoire n'est plus accessible ou qu'il a été considérablement modifié (Blaser *et al.*, 2004; Desbiens, 2007; Huberman, 2022).

Sensibilité de l'orignal aux activités anthropiques. L'orignal (*Alces americanus*) est l'un des mammifères terrestres les plus répandus dans les forêts boréales et mixtes de l'hémisphère nord (Telfer, 1984; Timmermann et Rodgers, 2005). Il est un maillon important dans la chaîne alimentaire, étant source de nourriture pour les prédateurs tels que le loup (*Canis lupus*) et l'ours (*Ursus americanus*), et les nécrophages tels que le renard roux (*Vulpes vulpes*) et le corbeau (*Corvus corax*) (Timmermann et Rodgers, 2005). En plus de son rôle écologique, l'orignal constitue traditionnellement une source de nourriture, de vêtements et d'outils pour les Premières Nations depuis des siècles (Crete, 1987; Priadka *et al.*, 2022). Des preuves archéologiques et des pétroglyphes montrent par exemple que la relation entre les Premières Nations de l'Ontario et l'orignal est très ancienne (Timmermann et Rodgers, 2005). On décrit cet animal emblématique dans plusieurs légendes sacrées de différents peuples autochtones en Amérique du Nord (Leland, 1992; Morriseau, 1965; Stevens, 1971; Stone, 1999). L'orignal est un animal important dans les cultures autochtones et toutes les activités liées à sa chasse ou à l'utilisation des ressources qu'il fournit sont des occasions pour la transmission des savoirs traditionnels entre membres de la famille et de la communauté (Blaser *et al.*, 2004; McLaren, 2012; Priadka *et al.*, 2022).

Le domaine vital se définit par l'ensemble des déplacements d'un animal dans son habitat, soit l'aire utilisée pour accomplir ses activités, incluant la recherche de nourriture, la reproduction et le soin aux jeunes (Burt, 1943; Dussault *et al.*, 2005; Osko *et al.*, 2004). La taille du domaine vital d'un animal est souvent déterminée par la qualité de l'habitat. Par exemple, puisque les orignaux évitent généralement de s'approcher des routes et des chemins forestiers, il a été suggéré que la corrélation positive entre la taille du domaine vital et la proportion de routes et chemins qu'il contient pourrait refléter une compensation pour la perte d'habitat (Laurian *et al.*, 2008a). Chez l'orignal, la superficie du domaine vital varie d'une vingtaine à quelques centaines de km^2, selon la région considérée et les ressources disponibles (Blouin *et al.*, 2021; Crête, 1988). L'habitat propice à l'orignal dans la forêt boréale est composé d'une mosaïque de peuplements feuillus et mixtes en régénération et de peuplements de conifères matures. Les peuplements feuillus et les arbustes fournissent de la nourriture tout au long de l'année tandis que les conifères matures offrent un abri (Courtois, 1993; Dussault *et al.*, 2006). Les milieux humides sont très fréquentés par l'orignal au printemps et en été (Tendeng *et al*., 2016). Quand l'orignal se trouve dans un milieu dans lequel la nourriture est abondante, il peut parfois tolérer un plus grand risque pour sa survie. Par exemple, en s'exposant davantage aux prédateurs en restant dans des habitats hautement perturbés offrant peu d'abri ou en se déplaçant sur les routes ou à proximité, augmentant ainsi le risque de collisions avec les véhicules en circulation (Barnas *et al.*, 2023; Dussault *et al.*, 2005; Laurian *et al.*, 2008a).

La coupe forestière, les brûlis et les chablis peuvent avoir des effets positifs sur l'orignal. Les zones récemment perturbées peuvent en effet être bénéfiques en créant des espaces ouverts permettant la régénération forestière, fournissant ainsi une nourriture de choix pour l'orignal (Kunkel et Pletscher, 2000; Tendeng *et al.*, 2016). Cependant, l'orignal peut éviter les endroits perturbés si la prédation, la chasse, le trafic routier et le bruit augmentent (Kunkel et

Pletscher, 2000; Laurian *et al.*, 2008b; Martins-Oliveira *et al.*, 2021; Radle, 2007; Tendeng *et al.*, 2016; Wattles *et al.*, 2018).

La perte et la fragmentation de l'habitat de l'orignal par l'exploitation forestière sont un enjeu majeur pour les Eeyouch (Feit, 1987; Jacqmain *et al.*, 2012; Jacqmain *et al.*, 2008) et les Anicinapek (Germain, 2012; Larouche, 2008; Tendeng *et al.*, 2016). Les coupes totales à grande échelle dans les forêts de conifères sont critiquées par les Eeyouch puisqu'elles réduisent le couvert forestier essentiel pour l'orignal, diminuent la connectivité entre les habitats saisonniers et rendent les zones de chasse peu attrayantes (Jacqmain *et al.*, 2012). Bien que les routes soient généralement évitées par l'orignal, elles peuvent le rendre plus vulnérable aux collisions avec les véhicules (Dussault *et al.*, 2007; Laurian *et al.*, 2008b; Wattles *et al.*, 2018). La faune terrestre est affectée par le bruit produit par les activités d'exploitation minière, occasionnant des déplacements sur de plus grandes distances, l'utilisation d'un plus grand domaine vital, la sélection d'un habitat de plus faible qualité, l'amenuisement du taux de survie des jeunes et même l'augmentation des risques d'avortement, réduisant ainsi les chances de survie de l'ensemble de la population (Martins-Oliveira *et al.*, 2021; Radle, 2007).

Plusieurs facteurs de stress, d'origine naturelle (p. ex. : maladies, insectes, climat, chablis, incendies forestier) ou humaine (p. ex. : exploitation forestière, minière et énergétique), peuvent affecter la santé des orignaux. Les perturbations induisent une réponse de stress de l'axe hypotalamo-hypophyso-surrénalien contrôlant la sécrétion de glucocorticoïdes (ou cortisol) dans l'organisme (Di Francesco *et al.*, 2021; Sherwood *et al.*, 2016). La sécrétion de cortisol dans le sang provoque l'accélération des fonctions cardiorespiratoires, la rétention d'eau, la mobilisation des substrats énergétiques et structuraux, soit des réponses qui peuvent être bénéfiques selon la situation (Santos *et al.*, 2018; Sherwood *et al.*, 2016; Vera *et al.*, 2017). Toutefois, en présence de stress chronique chez l'animal, la libération continue de cortisol peut entraîner une inhibition de la croissance, une perte musculaire et une suppression des systèmes immunitaire et reproducteur, réduisant sa capacité à survivre, à fuir ses prédateurs, à se reproduire et à se défendre des parasites (comme la tique d'hiver

Dermacentor albipictus) et maladies (Charbonnel et al., 2007; Cyr et al., 2007; McCann et al., 2013; Sheriff et al., 2011).

Afin d'évaluer le niveau de stress des orignaux en fonction de la présence (ou non) d'activités anthropiques dans leur domaine vital ou de causes naturelles, le niveau de cortisol peut être mesuré dans le sang, la salive, les fèces ou le poil (Macbeth *et al.*, 2010). Ce dernier séquestre l'hormone de manière plus stable et sur une plus longue période, c'est pourquoi il a été priorisé dans cette étude (Russell *et al.*, 2012; van Holland *et al.*, 2012). En effet, la concentration de cortisol dans le poil est représentative de la concentration dans l'organisme durant la période de croissance du poil et peut représenter des semaines ou des mois de sécrétion de cortisol selon la longueur du poil (Macbeth *et al.*, 2010; Sheriff *et al.*, 2011). La méthode non invasive de mesure du cortisol pilaire (dans le poil) a déjà été éprouvée sur différentes espèces animales telles que le grizzly (Macbeth *et al.*, 2010), le caribou (Ewacha *et al.*, 2017), le lièvre (Lavergne *et al.*, 2020), le loup (Ewacha, 2016), le lynx (Terwissen *et al.*, 2013) et l'orignal (Ewacha, 2016; Lis, 2016; Spong *et al.*, 2020). La concentration de cortisol pilaire peut varier selon le type et l'emplacement du poil échantillonné (Ashley *et al.*, 2011; Macbeth *et al.*, 2010).

Objectifs et hypothèses. L'objectif général de ce projet était de caractériser les conséquences des activités anthropiques, incluant l'activité minière, sur l'utilisation par les Eeyouch et les Abitibiwinnik des milieux humides de Eeyou Istchee Baie-James. Le projet comprend trois objectifs spécifiques, dont deux ont une approche inductive (sans hypothèse) et un a une approche hypothético-déductive.

Objectif spécifique 1 : Documenter les activités traditionnelles pratiquées par les Eeyouch et les Abitibiwinnik dans les différents types de milieux humides.

Objectif spécifique 2 : Évaluer les effets des activités anthropiques sur les milieux humides et sur les activités traditionnelles des Eeyouch et des Abitibiwinnik.

Objectif spécifique 3 : Mesurer le niveau de stress des orignaux en fonction de la présence ou non d'activités anthropiques dans leur domaine vital.

Hypothèse : Le stress subi par l'orignal augmente et son état général de santé diminue lorsque des activités anthropiques se trouvent à l'intérieur de son domaine vital ou lorsqu'il est infesté par la tique d'hiver.

La première partie fait une introduction générale sur le thème de l'étude. Le Chapitre I expose les résultats de la caractérisation et de l'utilisation des milieux humides par les Eeyouch et les Anicinapek et les conséquences des activités anthropiques sur leur mode de vie traditionnel. Ce chapitre est rédigé en anglais afin de faciliter le processus de publication dans une revue scientifique. Les conclusions générales de l'étude sont présentées dans la dernière partie.

1. A MIXED-METHODS APPROACH TO DOCUMENTING FIRST NATIONS WETLAND PERCEPTIONS IN EEYOU ISTCHEE JAMES BAY

1.1 Abstract

Industrial development and exploitation of natural resources have caused changes in Eeyou Istchee James Bay, a territory with a significant proportion of wetlands. Concerns have been raised by local Indigenous communities, and this study aimed to improve our understanding of the cultural use and importance of wetlands. It also sought to assess the effects of human activities on traditional activities such as moose (*Alces americanus*) hunting practiced by local Indigenous communities in wetlands. The cultural connection to wetlands was qualitatively assessed through interviews with 12 land users from the Mistissini Eeyou (Cree) and Abitibiwinni (Anishnaabe/Algonquin) communities. Then, the cortisol levels in the hair of 38 moose was quantitatively assessed to examine how human-caused disturbances (road density) within their habitat affects their stress levels. Land users unanimously described wetlands as being primarily wildlife habitats, therefore being indirectly essential to Indigenous cultures. A high level of land disturbance and the fact of only practicing cultural activities occasionally undermine the importance of the connection to the land and to wetlands. Analyses of cortisol concentrations could not show an effect of anthropogenic disturbances on moose stress level, as the overall disturbance rate was rather low in the study area. The winter tick (*Dermacentor albipictus*), however, significantly increased moose stress level. This study underscores the importance of wetlands for Indigenous peoples and the need to consider their interests in development projects. Additionally, it provides valuable baseline data on moose hair cortisol concentrations for the development of a non-invasive population monitoring tool.

Keywords: Eeyou Istchee James Bay, wetlands, Eeyou, Abitibiwinni, moose, cortisol

1.2 Introduction

In Canada, the importance of the land for Indigenous people cannot be overstated. It is not merely a source of natural resources for subsistence, but it also holds cultural significance. The land provides a space for cultural learning and a sense of attachment that is integral to the well-being of Indigenous communities (Basile *et al.*, 2017). Cultural activities such as hunting, fishing, and ceremonies contribute to a shared understanding of the land among community members (Davidson-Hunt and Berkes, 2003; Toombs *et al.*, 2022), and the passing down of Indigenous ecological knowledge from generation to generation testifies to the depth of this relationship (Tobias et Richmond, 2014).

Northern Quebec, known for its abundant natural resources, has witnessed extensive exploitation by extractive industries, resulting in landscape disturbances that not only affect local Indigenous communities, but also the surrounding biodiversity (Asselin, 2011; Gauthier et Vanthuyne, 2022; Royer et Herrmann, 2013). Historically, colonial dynamics have excluded Indigenous perspectives from land management, making it now important in the context of reconciliation to bridge Indigenous and land managers' perspectives to sustain landscape value for all stakeholders (Bélisle *et al.*, 2021; Bélisle *et al.*, 2022; Jacqmain *et al.*, 2012). At subarctic and boreal latitudes, communities have reported that environmental changes, of both natural and anthropogenic origin, have affected their ability to access safe drinking water and traditional foods, reduced their capacity to engage in physical activity, changed ice conditions, and caused unpredictable weather patterns (Herrmann *et al.*, 2012; McLaren, 2012; Priadka *et al.*, 2022). These consequences have had significant effects on their physical, mental, and spiritual health and overall well-being (Cloud et Redvers, 2023; Ford, 2012; Kuhnlein et Chan, 2000; Turner et Clifton, 2009).

A wetland is an expanse of land that is either submerged in water or thoroughly saturated. The water presents in non-submerged wetlands typically originates from underground, gradually seeping up from an aquifer or spring. Although these areas may appear dry on the surface, they are characterized by the presence of bogs or fens, which are covered with layers of organic matter. Wetlands are of little interest to the extractive industries in boreal Quebec, who rather focus on wood, minerals and water (for energy). Since wetlands are not considered profitable, they are excluded from consultation with communities and thus rarely discussed, especially in terms of their cultural value. There is hardly any information available about the practice of traditional activities in these specific areas in Eeyou Istchee, and they are often considered to be the same as other watercourses (lakes, rivers), even though they have distinctive advantages for flora and fauna. Wetlands hold high importance in the Eeyou Istchee James Bay region of northern Quebec, serving as a crucial component of Indigenous cultures and traditional activities, such as hunting, fishing and gathering (Bélisle *et al.*, 2021; Germain, 2012; MacMillan *et al.*, 2023; Shields et Guevara-Salamanca, 2023). Big game hunting, especially for moose (*Alces americanus*), is particularly popular among community members.

Moose, a culturally salient species for several Eeyou and Anishnaabe communities (Badry *et al.*, 2023; Bearskin et Berkes, 1984; Priadka *et al.*, 2022; Tendeng *et al.*, 2016), relies heavily on wetlands for its survival (Laforge *et al.*, 2016; Morris, 2002). Moose use wetlands almost year-round and they prefer habitat near wetlands and small lakes during calving, summer, and winter seasons (Francis *et al.*, 2021; Tendeng *et al.*, 2016). During the calving season (when calves are the youngest) and in the fall (hunting season), moose avoid roads while utilizing habitats with greater forage availability, including wetlands (Francis *et al.*, 2021; Morris, 2002). This information was also shared by Eeyou and Anishnaabe hunters, who mentioned the importance of wetlands for females during calving and more generally as foraging and heat protection areas (MacMillan *et al.*, 2023; Tendeng *et al.*, 2016).

Habitat disturbances could affect moose well-being and stress level, ultimately causing population decline (Arsenault *et al.*, 2019; Fohringer *et al.*, 2022). A short-term stressful situation results in physiological effects that prepare the body for fight or flight through catabolic reactions, which ultimately enhance individual survival (Romero and Butler, 2007). These physiological responses, however, trade off against growth, immunocompetence, reproduction, and even long-term survival (Sapolsky *et al.*, 2000). Chronic stress due to long-term exposure to natural disturbances (e.g. sickness, winter tick infestation, high temperature, drought) and anthropogenic disturbances (e.g. natural resource extraction, road traffic, noise), may thus reduce individual and population performance and general health, with direct implications for the management and conservation of wildlife populations (Bhardwaj *et al.*, 2022; Fohringer *et al.*, 2022; Montillo *et al.*, 2019; Spong *et al.*, 2020; L. Nelson *et al.*, 2023). Yet, relatively little is known about how chronic stress levels vary across wild moose populations and factors contributing to increased chronic stress levels.

The aim of this study was to enhance our understanding of the significance and utilization of wetlands by Indigenous communities within the context of natural resource development. Additionally, we aimed to assess the effects of industrial activities on wetlands and on moose hunting by Indigenous communities. The study involved a qualitative investigation of the cultural connection to wetlands through semi-directed interviews conducted with Eeyouch (Cree) in Mistissini and Abitibiwinnik (Anishnaabeg/Algonquins) in Pikogan. Then, moose hair samples were collected to assess the effects of anthropogenic disturbances on stress levels. By improving the understanding of the role of wetlands in sustaining Indigenous practices and by evaluating the stress level of moose populations due to disturbances, this study will contribute to implementing management measures to address the challenges posed by environmental disturbances and ensure the preservation of both cultural heritage and ecological balance.

1.3 Material and methods

1.3.1 Study site

The study area was located in the region of Eeyou Istchee James Bay, Northern Quebec, Canada, specifically the territory of the Cree Nation of Mistissini (50° 25' 6.4122", -73° 52' 9.408") and the northern part of the territory of the Abitibiwinni First Nation (48° 36' 0.0504", -78° 7' 6.5382") (Figure 1.1). As part of the Canadian Shield, the study area is rich in minerals such as gold, silver, and copper. Following the last ice age, glacier retreat contributed to the formation of numerous lakes, rivers, and wetlands. The study area is covered by vast expanses of boreal forest, primarily composed of black spruce (*Picea mariana*), paper birch (*Betula papyrifera*) and eastern larch (*Larix laricina*), with lesser amounts of white spruce (*Picea* *glauca*), jack pine (*Pinus banksiana*), and trembling aspen (*Populus tremuloides*) (Robitaille and Saucier, 1998). Various shrubs are also present, such as Labrador tea (*Rhododendron groenlandicum*), and some berry-producing shrubs such as raspberry (*Rubus idaeus*), blueberries (*Vaccinium angustifolium* and *V. myrtilloides*), and cloudberry (*Rubus chamaemorus*). The density of forest stands decreases from south to north, and closed-crown stands are gradually replaced by lichen woodlands in the forest tundra (Payette *et al.*, 2001). The forest tundra is characterized by extensive areas of lichens, which serve as the primary source of food for migratory caribou (*Rangifer tarandus caribou*). Wildlife density is low and include large mammals such as moose, caribou, and black bear (*Ursus americanus*); small mammals such as porcupine (*Erithizon dorsatum*) and snowshoe hare (*Lepus americanus*); fur-bearing mammals such as beaver (*Castor canadensis*) and American marten (*Martes americana*); migratory birds such as Canada goose (*Branta canadensis*); and fish such as lake whitefish (*Coregonus clupeaformis*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), and lake sturgeon (*Acipenser fulvescens*).

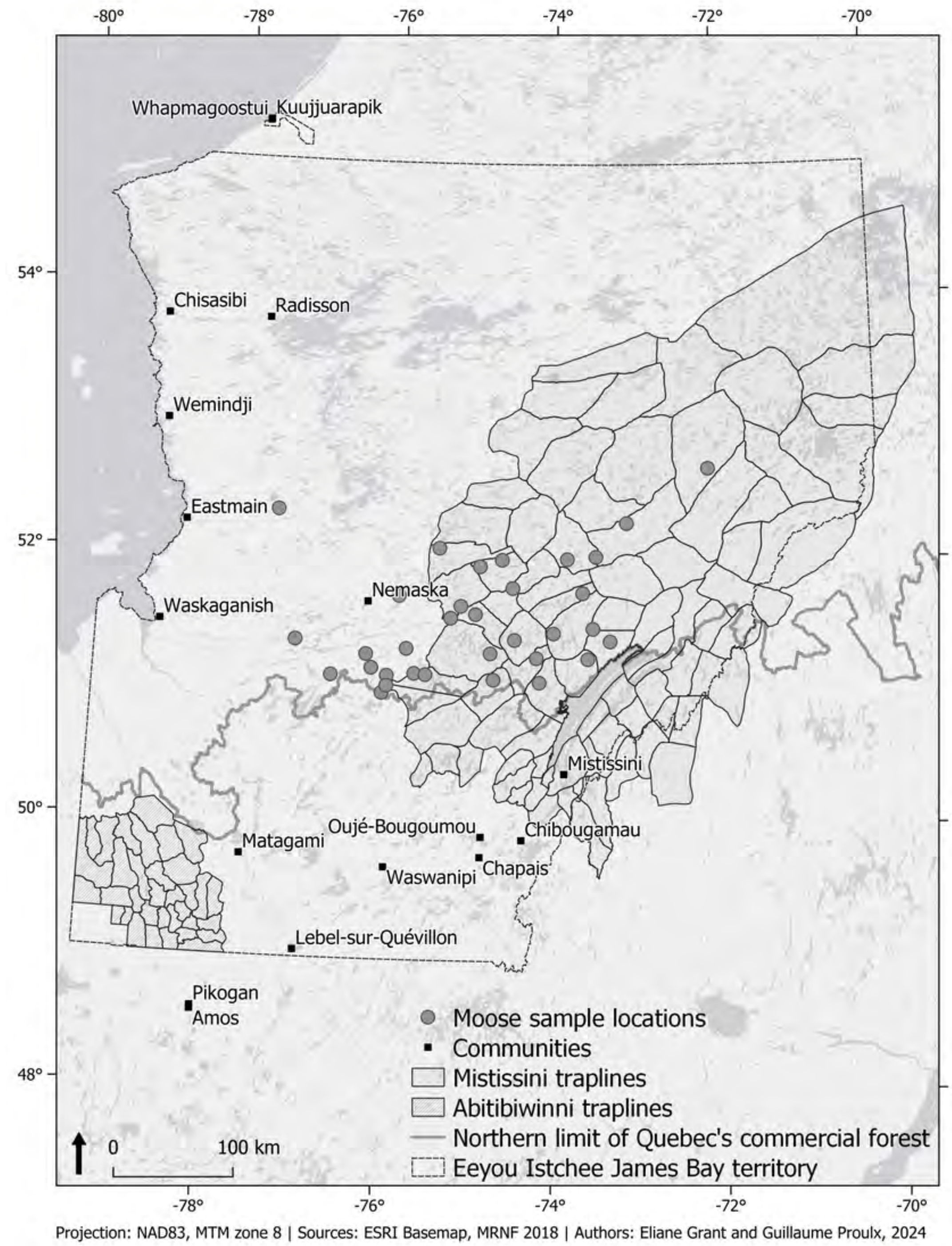

Figure 1.1
Study area showing Abitibiwinni and Mistissini communities and traplines, as well as locations of free-ranging moose hair sampling in Eeyou Istchee James Bay.

The study area encompasses the family hunting grounds of the Cree Nation of Mistissini (81,000 km^2, 78 hunting grounds called traplines) and the Abitibiwinni First Nation (11,430 km^2, 34 hunting grounds) (Figure 1.1). These hunting grounds are used by a hunting group, usually a family, and are passed down from one generation to the next (Bishop and Morantz, 1986; Scott, 2018). Cree hunting grounds are managed by an official administrator known as a tallyman (Awashish, 2018; Cree Trappers Association, 2009), while Abitibiwinni hunting grounds are under the unofficial responsibility of family members.

The differences in anthropogenic disturbances between the southern, central, and northern parts of the study area are notable. In the southern region, on the Abitibiwinni territory, there is a significant presence of forestry activities causing habitat fragmentation (Bélisle *et al.*, 2022). In contrast, the central region, on the territory of the Cree Nation of Mistissini, is characterized by a predominant mining industry (Asselin, 2011), which causes land clearing, soil erosion, and pollution (Bresson *et al.*, 2022; Gauthier et Vanthuyne, 2022). Moving further north towards the territory of the Cree Nation of Nemaska, the level of anthropogenic disturbances is comparatively lower. Overall, the varying degrees of anthropogenic disturbances across the study area highlight the diverse environmental challenges faced by different communities within the region (Bélisle *et al.*, 2022; Fuentes *et al.*, 2020).

The *James Bay and Northern Quebec Agreement* (1975) and the *Agreement concerning a New Relationship between le Gouvernement du Quebec and the Crees of Quebec*, also known as the *Paix des Braves* (2002), regulate activities on the Cree territory, whereas no such agreement has yet been signed on Abitibiwinni territory. The *Paix des Braves* agreement has given the Eeyouch an active role in decision-making processes about the management of their land and natural resources, thereby enabling them to ensure that their cultural beliefs and traditions are respected and preserved (Salée and Lévesque, 2010).

1.3.2 Interviews

Semi-directed interviews were conducted to gain a better understanding of the relationship between wetlands and cultural practices. The study was reviewed and approved by the Ethics

Review Board of the Université du Quebec en Abitibi-Témiscamingue (certificate #2019-09; ANNEXE A).

Between December 2020 and August 2022, 12 semi-directed interviews were conducted with Abitibiwinni participants (n=5) in French, and Mistissini participants (n=7) in Cree and English. All participants were male because moose hunters were selected. Participants in Mistissini were older on average (66 vs. 45 years old) and their preferred language was Cree. A Cree-English translator was thus present during the interviews, and some participants were accompanied by a family member who also assisted with translation. Interviews lasted 45 minutes on average. The interviews were all recorded, and transcripts were made using the Trint software (Trint Ltd, Toronto, Canada). Subsequently, the primary author manually reviewed the transcripts to ensure accuracy.

The recruitment method employed in this study was non-probabilistic purposive sampling. Participants were selected based on a predetermined set of criteria, including experience, location, and peer recognition (Coyne, 1997; Teddlie et Yu, 2007). It was deemed important to have individuals with experience in moose hunting and other traditional activities to provide valuable insights and perspectives. The participants' knowledge and expertise were highly regarded and contributed greatly to the success of the study. The number of participants was determined based on information saturation, i.e. when additional interviews did not yield new data (Creswell and Poth, 2016). The interview transcripts were subjected to a qualitative thematic analysis to identify the main themes (Braun and Clarke, 2006; Paillé and Mucchielli, 2012).

At the onset of the interviews, general inquiries were made regarding the lifestyle and cultural practices of the participant. This initial phase was crucial in establishing their connection to the land. Subsequently, questions were directed towards wetlands and how they are utilized. Participants were also asked to provide their perspective on the evolution and disruptions of wetlands over time, including the factors that contribute to such changes. Finally, the consequences of these changes on cultural practices were explored. The interview guide is provided as ANNEXE B.

1.3.3 Moose hair collection

In order to evaluate the effect of disturbances on moose stress level, moose hair were sampled to quantify slowly incorporated cortisol (stress hormone), which reflects a long-term average of the stress response (Russell *et al.*, 2012; van Holland *et al.*, 2012). Moose hair samples were obtained from two different sources: (1) from free-ranging moose in Eeyou Istchee (n=33 females) and (2) from individuals at an animal shelter in Abitibi-Témiscamingue (n=2 females; 3 males). The samples from the first group were obtained from moose chemical immobilizations[1] carried out on behalf of the *Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune and des Parcs* (MELCCFP)[2] as part of a telemetric monitoring project (Lamglait *et al.*, 2021). These immobilizations were carried out between the Mistissini and Nemaska communities, north of the northern limit of Québec's commercial forest, from February 14 to 22, 2021, and targeted mature (adult) females (Figure 1.1). Each anesthetized moose underwent an evaluation of the level of winter tick infestation and a shoulder hair collection.

The samples from the second group were collected from Refuge Pageau in Amos, Quebec, which is located ca. 15 km southeast of the Pikogan Abitibiwinni community in the Abitibi-Témiscamingue region. This shelter provides shelter for wild animals requiring rehabilitation, with the goal of reintroducing them back into the wild after they have recovered, if feasible. When it is not possible to release an animal back into the wild, the Refuge Pageau's mission continues by providing long-term accommodation. The selection of the Refuge Pageau was based on the need for reference data to compare with the samples from free-ranging moose. At the time of writing, no other study had provided cortisol concentration data for the study area, highlighting the importance of our research in contributing to the understanding of stress levels in moose populations. The reference samples were selected based on their

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[1] The use of a tranquilizing device to chemically induce immobilization to allow measurements to be made on animals.

[2] Opportunistic sampling since limitations related to the covid-19 pandemic prevented us from sampling moose closer to the study communities.

location close to the study area, and because they were in a controlled environment without predators and with a continuous source of food, hence thought to experience a low level of stress, despite the continuous presence of visitors. At the time of hair collection, the moose (3 males and 2 females) had been in the shelter between 6 months and 8 years (this also reflects their age). All the moose hair samples (from natural or controlled environment) have been plucked on the shoulder, stored in absorbent paper to remove any humidity and sent for cortisol analyses to Reproductive Programs and Research, Toronto Zoo.

1.3.4 Moose cortisol analyses and enzyme immunoassay (EIA) validation

The follicles were extracted, and the hair was trimmed into 5 mm pieces before being weighed and placed in 7 ml glass scintillation vials. Following this, all hair samples underwent a 10-second vortex wash with 4 ml of 100% methanol, with the methanol then promptly removed using a pipettor (Di Francesco et al., 2021). The purpose of this washing procedure is to eliminate surface contamination without initiating the extraction of glucocorticoids (GCs) from the hair shaft. Hair samples weighing 0.0451-0.0578 g were then treated with 100% methanol at a ratio of 0.01 g of hair/ml of methanol on a rotator plate (MBI Lab Equipment orbital shaker, 100 rpm) at room temperature for 24 hours. Following centrifugation (5 min at 2400 x g), the resulting supernatant (hair extract) was transferred into new 7 ml glass vials. The hair extracts were then stored at -20°C until hormone analysis.

For cortisol analysis, 3920 μl of each hair extract was evaporated in a 37°C water bath under a fume hood. The dried extract was reconstituted in 140 μl EIA buffer for a 28-fold concentration. Cortisol was measured using an EIA based on the protocol from C. Munro (University of California, Davis) described by Majchrzak et al. (2015). Microtiter plates were coated with 50 μl of hormone-specific antibody (cortisol antibody R4866) diluted 1:10,250 in coating buffer (50 mm bicarbonate buffer, pH 9.6). After overnight incubation at 4°C, plates were washed with 0.15 M NaCl and 0.05% Tween 20, and the wells loaded with 50 μL of hormone standards or reconstituted extracts along with 50 μL of cortisol horseradish peroxidase conjugate diluted 1:33,400 in EIA buffer. Following a two-hour room temperature incubation, plates were washed and 100 μL substrate solution (ABTS) added, and then absorbance was measured at 405 nm using a spectrophotometer (Epoch 2 microplate reader, BioTek, Winooski, VT, USA). All samples and standards were run in duplicate.

Parallel displacement between the standard curve and serial dilutions of hair extract was used as an indirect measure of assay specificity. A representative pooled sample of hair extracts was concentrated 80-fold, serially diluted two-fold in assay buffer and run on the cortisol assay alongside the standard curve. The data were plotted as log(relative dose) vs. percent antibody bound and sample concentration was selected based on 50% binding of the pooled sample curve.

Recovery of known amounts of cortisol was calculated to examine possible interference of components within the extract with antibody binding. Increasing concentrations of cortisol standard were added to a pool of dried extract reconstituted to be 28-fold concentrated. The percent recovery was calculated using this formula: amount observed/amount expected x 100%, where amount observed is the value from the spiked sample minus the endogenous cortisol in the unspiked moose hair extract, and the amount expected is the amount of cortisol added.

To evaluate the consistency of results, the calculation of intra- and inter-assay coefficients of variation (CV) was performed. The intra-assay CVs were continuously monitored in real time on each plate, with only values from duplicates showing <10% CV being recorded as data. Inter-assay CVs were assessed by using duplicate fecal extract controls (25% and 55% binding) on each plate.

1.3.5 Statistical analyses

Microsoft Excel was used to assess parallelism and hormone recovery. For parallelism, the data were plotted as log(relative dose) vs % antibody bound, and linear regression analysis was conducted on values within the linear range of the sample and standard curves. The probability of a significant difference between the resulting slopes was determined, with a p-value of less than 0.05 indicating a significant difference between the slopes (Soper, 2021).

Also, hormone recovery data were plotted as hormone added vs. hormone recovered and were also evaluated using linear regression analysis.

To test the hypothesis that anthropogenic disturbances increase stress, a t-test was used to compare the mean cortisol concentrations of the control group (refuge) and free-ranging individuals. In this analysis, the age and sex of the individuals were not differentiated. Prior to conducting the t-test, it is important to ensure that both the normality and variance homogeneity of the data are met. In general, cortisol concentrations followed a normal distribution, with the exception of a few values above the mean (IDs 38 and 19).

A Poisson regression model was used to establish the correlation between winter tick (*Dermacentor albipictus*) infestation and cortisol concentration.

1.3.6 Anthropogenic disturbances analysis

The loss of biodiversity is primarily caused by habitat conversion, degradation, and fragmentation, as well as the introduction of exotic species. Road density is often the most reliable predictor of habitat effectiveness for species that are sensitive to human activities, particularly large mammals and birds, including herbivores and carnivores (Gucinski, 2001), as moose (Beazley *et al.*, 2004). There is a positive correlation between home-range size and the proportion of roads within, indicating that moose may compensate for habitat loss (Laurian *et al.*, 2008a). The analysis of anthropogenic disturbances was conducted using the ArcGIS Pro program, utilizing the Address Québec (AQRéseau+) road network database. This database includes forestry roads, and the electric transmission lines were also added to the layer of roads. The outgoing layer had a resolution of 250 meters. We calculated the total length of roads within a 1 km and 10 km radius around the coordinates of each sampled moose. Road density was expressed as km/km^2, indicating the number of kilometers of road within a circular area with radii of 1 km or 10 km, without overlap between the radii. All categories of roads and hydro lines were analyzed with equal weight, as there is a large proportion of roads that are unclassified or whose classification is unknown. Consequently, high-traffic roads were assumed to cause the same disturbance as winter roads or a 60-meter hydro line in this analysis.

To assess the consequences of human activities on individual moose, we measured cortisol levels and correlated them with road density and the presence of other anthropogenic disturbances (e.g., mining, forestry, hydroelectric infrastructure) in their habitat. We also considered natural disturbances, such as the number of winter ticks found on each sampled moose.

We carried out all geomatic analyses using ArcGIS 10.6.1 (ESRI Inc., Redlands, California, USA), and all statistical analyses with R 4.10.0 (R Development Core Team 2022).

1.4 Results

1.4.1 Importance and utilization of wetlands by Indigenous people

All the participants were men between 37 and 80 years old and were or had been hunters, fishermen, and trappers. The observations made by the Abitibiwinnik and Eeyouch regarding their respective territories are quite distinct. Most Abitibiwinni participants were not tallymen but rather members of the tallyman's family or occasional land users who had full-time jobs and visited the land part-time. Most Eeyou participants were tallymen who were or had been full-time hunters/trappers.

The interviews started by asking the participants to provide their definition and description of wetlands and the significance they hold for them. Whereas the Abitibiwinnik classified wetlands based on specific types, such as lakes, marshes, rivers, and bogs, the Eeyouch generally distinguished between two main categories: wetlands with water at the surface, and those without.

> “Not all of the wetlands are the same. Some are completely dry [on the surface], and some are less [dry] or [have] more little swamp areas.” M2 [translation Cree to English]

> “[There are] two kinds. One with a little bit of lakes and creeks, and some dry wetlands too. […] Dry on top and water at the bottom” M5

The organic layers covering bogs or fens could serve as a disguise, concealing the water that lies beneath. This is what the participant was referring to in the previous citation when he said that some wetlands seem “dry”.

It was undeniable for all participants that wetlands are important wildlife habitats.

> “The Crees need the wetlands. [...] It's very important to us. For me. I was taught how I can use it. It's where I go to find what I need. Specially looking for food. You'll find a moose, if it's not a moose, it's something else.” M6

> “[Wetlands are] important for animals, like muskrats and snow geese, because they provide food to wildlife.” M4

> “If we're talking about ponds, not really, but if we're talking about rivers and lakes, that's important. They allow us to get around and find game too. That's often where we find them.” P5 [translation French to English]

Some participants also mentioned the benefits of vegetation found along the wetlands. They inherited this knowledge from their parents and grandparents when they lived on the land before colonisation began.

> “During the winter, you want your cabin to be by a marshland to get moss to warm up. A certain kind of moss, the one you get in the marsh, it's good for insulation. Not the one you get from the dry ground is not as insulated. Not just for insulation, it's good for diapers. The pink one is the best one. If a kid gets a rash, or skin problem, it's the best thing to use, to clean. It's something that we use often. Smoking fish, we use that. Cleaning fish or meat. It's never dirty because it's always wet and clean.” M5

When asked about the importance of wetlands to them, their responses were always formulated in an indirect manner, i.e. mentioning wetlands' importance to hunted, trapped and fished animals as a source of food, protection, provide medicine and habitat. Wetland types were typically distinguished by the wildlife species they support:

> “So it depends if he's looking for a moose, he goes there [points to a direction] and when he looks for beaver, he goes there [points to another direction].” M2 [translation Cree to English]

> “Wetlands are where moose is during the summer and where caribou is in the winter.” M1 [translation Cree to English]

> “It's inevitable that wetlands make me think of *muus* (moose). They need these environments, they need water, they need aquatic plants, they need to cool off in the water too, and to drink.” P3 [translation French to English]

Wetlands have been recognized as important ecosystems, but some participants take it a step further, asserting that wetlands are the very origin of life itself and they are central to Indigenous culture.

> “Wetlands and marshlands, this is what's going to keep the world turning. If there is no more, it's bad for everything, not for just one person” M6

> “I believe it's important for the animals. If you ruin their habitat, they won't be around that long. Actually, it's important for everyone” M7

This observation is shared mainly by the Eeyouch, while the vital role of wetlands was not so evident for the Abitibiwinnik. They recognized their ecological role, but were less familiar with them because of access issues. The Abitibiwinnik tend to avoid wetlands because their territory is easily accessible by roads and prefer to hunt for geese in nearby agricultural fields where they are abundant. It is important to note that this is a general trend among the Abitibiwinnik people, and not necessarily true for all individuals.

1.4.2 Disturbances affecting the traditional way of life

The discussions then turned to the types of cultural practices carried out in disturbed wetland environments. Various cultural activities were said to be practiced in wetlands, which are often affected by human interference. These activities include traditional fishing, hunting, trapping and gathering of medicinal plants, among others (Figure 1.2).

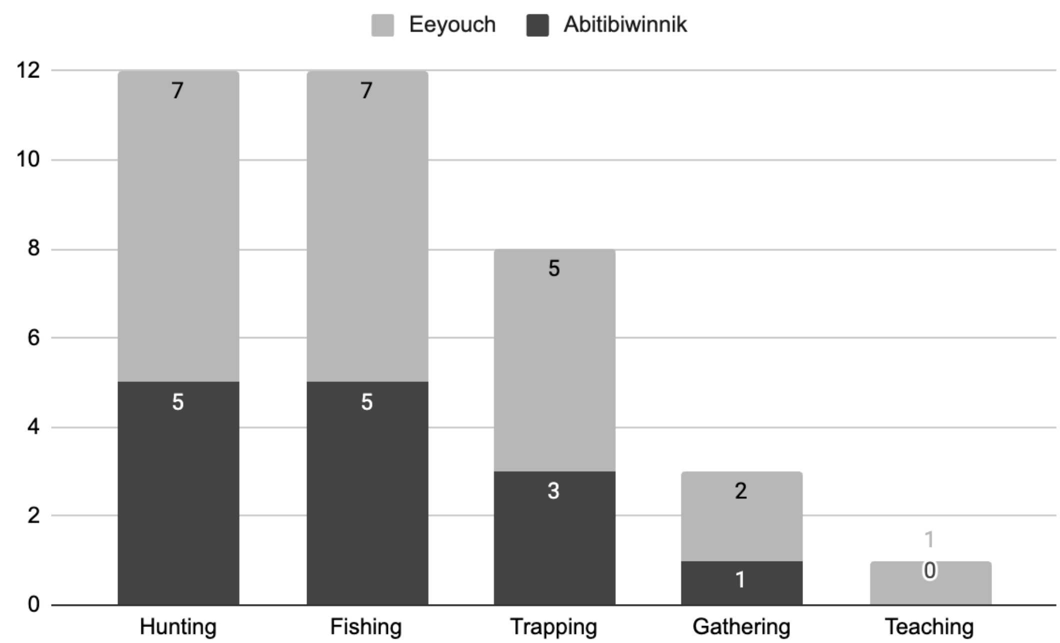

Figure 1.2
Summary of all cultural activities in or near wetlands for Eeyou (n=7) and Abitibiwinni (n=5) participants.

The participants highlighted several disturbances affecting cultural practices and challenging wetland conservation: hydroelectric development, forestry, and mining, as well as the construction of roads to support these various types of exploitation (Figure 1.3). They also identified natural disturbances or those indirectly caused by humans, such as climate change, wildfires, wildlife diseases, fluctuations in wildlife populations, and the arrival of new species, such as the bald eagle (*Haliaeetus leucocephalus*) coming from the south.

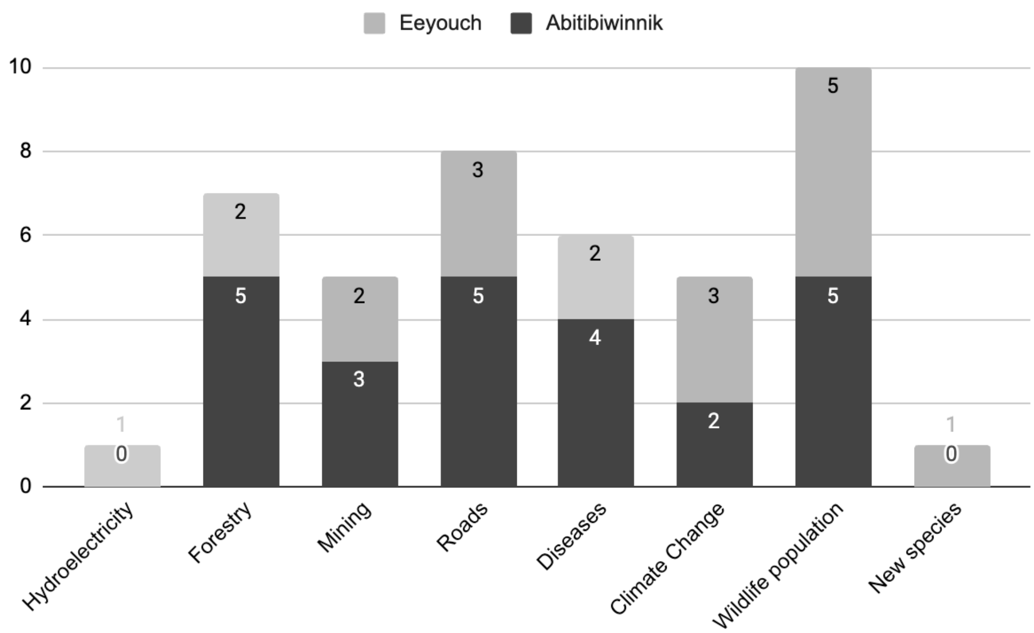

Figure 1.3
Number of Eeyou (n=7) and Abitibiwinni (n=5) participants reporting anthropogenic or natural disturbances affecting their traditional way of life in wetlands. Categories of anthropogenic origin: hydroelectricity, forestry (logging and silviculture), mining (infrastructure and maintenance), roads (direct and indirect) and those of natural origin: diseases (including parasites), climate change, wildlife population (decrease or increase), new species (in the area).

In Abitibiwinni Aki (territory of the Abitibiwinnik), forestry, mining and roads were said to have a significant effect on the majority of participants' capacity to engage in cultural activities (Figure 1.3). However, it is worth noting that hydroelectricity did not seem to be a significant disturbance in this area.

> "[Because of forestry] we need to go further to set traps and hunt for moose."
> P1 [translation French to English]

> “Clear-cutting scares away moose, there will be fewer for the next decade or so.” P1 [translation French to English]

> “In 1975, the road came to the river's edge, and a bridge was built to cross it the following year. The construction of this bridge changed the life of the river. The flow has been reduced, the river no longer flows as it used to, and many aquatic plants and algae have appeared.” P3 [translation French to English]

> “I've already seen geese in the mine's sedimentation basins. Not sure it's good for meat.” P3 [translation French to English]

In the territory of Mistissini, a minority of individuals surveyed were affected by forestry, mining, and hydroelectricity, whereas the presence of roads in the area has a moderate effect (Figure 1.3).

> “Where my trapline is, they all cut. Everywhere. Everywhere. There are hardly no woods [anymore]. All around where my camp is, all around is cut. All around.” M1

> “Well, I tried [to protect the trees]. [The forestry company] asked me: “Where you don't want cuts, just show me.” And I did: “Here. That's where the moose is in winter and no need to cut this.” [They said] Okay [but] When I went there in the winter time. No trees.” M1

> “When [Hydro-Quebec] used to work in that area, they used to leave things behind like 45-gallon cans [of helicopter fuel]. They would float around in this lake. So, there's one time [I] caught a fish that didn't look too good, you know, it was skinny and wicked or something. […] Hydro didn't clean the area.” M2 [translation Cree to English]

> “Logging roads cut connections between creeks and wetlands and lead some to dry out. And some are totally under water, and you never see them again, like for hydro projects.” M6

> “One time I was hunting beaver on that little pond and all of a sudden, BOOM, you can even see the ripples around the lake. That was it for the beaver, never showed up again. It scared him off. It was about 67 km from the mine. I don't believe them when [the mine representatives] say that [the blast] is only going [to be heard up to] 20 km.” M6

> “It's a big land and [the road to the mine] cuts right across and the caribou will attempt to move within few hundred kilometers away. […] There's no way to avoid the road for the animals.” M7

Even if remediation work is carried out to mitigate the consequences of development, it is rarely successful.

> “They even made a little rapid for the fish for them to come back, but it's been more than 10 years and still nothing.” M5

According to three tallymen eeyou who were interviewed, no anthropogenic disturbances have affected their traditional activities in wetlands. Moreover, one of the participants mentioned that his trapline is located in a protected area where forestry, mining, and hydroelectric activities are not permitted.

> “Pretty much the same, I didn't see any differences [over time]. I've been hunting moose and trapping marten and beaver for as long as I can remember. There has been no difference [in all these years].” M4

It appears that the optimal solution to preserve their traditional way of life is to protect areas from the exploitation of natural resources, as well as the infrastructure like roads that facilitate such activities.

The expansion of road networks in traditional Indigenous territories not only directly affects resource exploitation but also poses a major hindrance to traditional activities. According to the participants, the influx of non-Indigenous individuals into these areas leads to overuse of resources, such as excessive sport hunting, and appropriation of land by outsiders, impeding access for Indigenous communities. Consequently, conflicts arise between Indigenous and non-Indigenous individuals, particularly during hunting seasons.

> "They are too many roads, there are too many hunters." P2 [translation French to English]

> "I no longer hunt moose on the territory because it's too crowded and there are too many conflicts with non-natives." P4 [translation French to English]

> "I no longer use the southern portion [of my territory]. Non-natives have taken over that part, they go there on ATVs. They once blocked the road." P5 [translation French to English]

The participants from both communities mentioned disruptions of natural origin or indirectly caused by humans, such as climate change. Unusual variations in water levels, warming of both the air and water, snow layers, and changes in the quality of ice on rivers have been attributed to climate change. Changes in snowfall patterns and the quality of ice on water bodies during winter can affect travel safety.

> "Summer is too long, and winter is too short." M7

> "There's nothing else that [I] see that could affect the wetlands it's totally the climate change." M2 [translation Cree to English]

> "Safety is very, very important and you have to be more cautious to be out there as a hunter because of this, the changes that [I] see, the ice, you know, the water too." M2 [translation Cree to English]

Additionally, the participants have noticed an increase in the frequency of sick moose (abnormal organs or presence of parasites) and more frequent tick infestations. Some have also observed a significant increase in the population of certain species, such as wolves, white sucker (*Catostomus commersonii*), and to a lesser extent, beaver and moose. However, the majority of participants have identified these species (beaver and moose), as well as fish in general, specifically walleye and woodland caribou, as declining. One participant from Mistissini mentioned the arrival of the bald eagle in recent years, which they had never seen on their trapline before.

> “I don't know if it's linked to climate change, but we noticed that walleyes were less present in certain areas because the water is warmer. [...] It's too hot, that's why there are just *namebin* (white suckers).” P3 [translation French and Anishinaabemowin to English]

> “Today, I go to the same place I used to go when I was young, and then there's nothing left, there's no trace. You can't even see the moose that passed by. Nothing, nothing, nothing. You don't even see signs that there's one, you know, broken branches, a winter ravage, you don't see any of that. It's just totally changed.” P2 [translation French to English]

> “I guess that the wolf, they followed the roads. That's why there is hardly no beaver.” M1

> “I used to see [woodland caribou] everyday. They are not on the lake during the winter anymore. They were on the same lake before, but they left.” M4

> “Increase in number of moose on the west side of the trapline because of forest fire, they go where the forest is growing [back].” M4

The interviews indicated the cultural salience of moose and its link to wetlands. Moreover, moose is the only game hunted by all participants compared to other games hunted or fished.

1.4.3 Hair cortisol analysis

The concentration of hair cortisol in the samples ranged from 0.65-10.70 pg/mg with an average of 2.16 pg/mg (see ANNEXE C). Serial dilutions of pooled hair extract showed parallel displacement with the cortisol standard curve (t=0.16, p=0.88, df=5; see ANNEXE C). The measured hormone concentrations in the spiked samples correlated well with the expected concentrations of cortisol (r=0.99, p<0.001; see ANNEXE C). Inter-assay CV's were 8.4% (25% binding) and 1.0% (55% binding). The recovery was evaluated at 102.2% ± 2.6 [mean ± SE].

After verifying that there was no significant difference between the variances of the control and free-range group (Levene's test, df=0.0802, p=0.77), we performed a Welch two-sample t-test which showed that there was no statistically significant difference between the cortisol concentrations of the two groups (t=-1.5793, df=7.1241, p=0.1575; see ANNEXE C). They were thus analyzed as a single group thereafter.

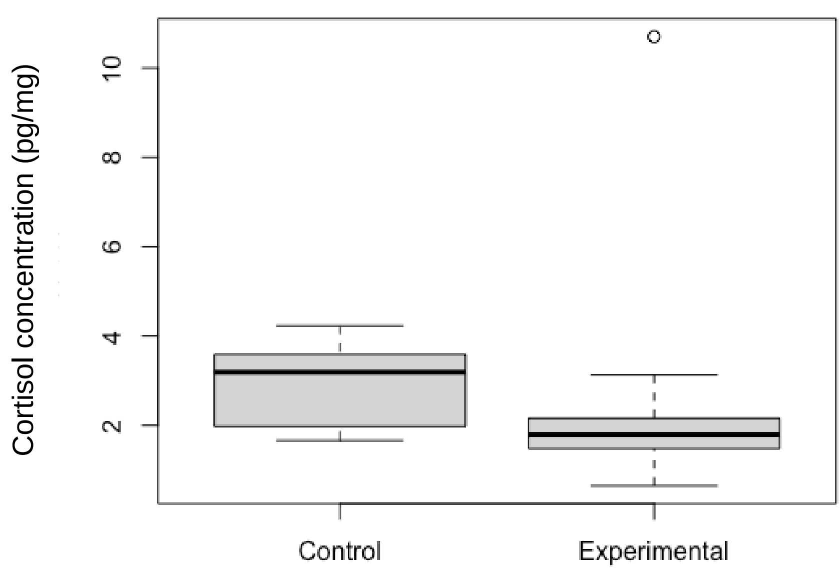

Figure 1.4
Shoulder hair cortisol concentrations for shelter (control) and free-range (experimental) moose.

A Poisson regression analysis was conducted to evaluate the effect of winter ticks on cortisol concentration in moose. The results indicate that with each additional tick found on a moose, there is a 49% increase of the cortisol concentration, which is statistically significant ($p < 0.0001$).

Road density averaged 0.52 km/km^2 (SD= 0.95) within a 1 km radius, and 0.50 km/km^2 (SD= 0.79) within a 10 km radius. The Poisson regression showed that road density was not significantly correlated with the cortisol concentration found in the sampled moose ($p = 0.559$ for a 1 km radius and $p = 0.312$ for a 10 km radius). Among the sampled moose, 16 individuals, accounting for 48% of the samples from the natural environment, had no roads within 1 km or 10 km radius.

1.5 Discussion

An indissociable whole. To begin, it was a difficult task to discriminate wetland-related information from the rest of the knowledge that has been generously shared by the participants. Traditionally, people consider themselves to be part of an indissociable whole, and it is everyone's duty to maintain the balance between all of the elements on the land, animate and inanimate (Cree Trappers Association, 2009; Tobias and Richmond, 2014). It therefore seemed strange for some participants to focus exclusively on wetlands, since they are part of a dynamic involving the whole landscape. However, they understood that science focuses on a few elements - one at a time. Furthermore, it is crucial to value Indigenous knowledge, which is currently facing the greatest risk of extinction, and to combine it with science to fill in the gaps in science-policy assessments (Bélisle *et al.*, 2022; Ray, 2023).

(Dis)connection to the land. The views of many of the participants revealed a deep-rooted attachment to the territory of Eeyou Istchee. To the Eeyouch, being present on their hunting grounds holds greater significance than simply hunting and fishing; they have a unique and central connection with Eeyou Istchee – its water, forests, plants, animals, and spirits – and their resulting identity is deeply intertwined with the nature of being Eeyou (Cree Trappers

Association, 2009). The amount of time spent on the territory and the variety of cultural practices related to wetlands were higher for people from the Mistissini community than the Abitibiwinni community. The frequency of visits to the land was lower for the Abitibiwinnik interviewed, and this could be explained by stronger territorial dispossession (Tobias and Richmond, 2014). Environmental dispossession processes have resulted in emotional and spiritual harm, including a diminished capacity to pass on Indigenous knowledge to younger generations and a decline in cultural pride (Tobias and Richmond, 2014).

How anthropogenic disturbances affect cultural practices. The history of disturbances on the land differs significantly between the two communities according to the participants. Since the early 20th century, forestry has been an integral part of the colonization of Abitibi by settlers of European descent. The two communities are not affected in the same way by forestry: 100% of Abitibiwinni's hunting grounds vs. 20% of Mistissini's are subject to forestry. It is therefore not surprising that the Abitibiwinnik mentioned that forestry and the construction of forestry roads have greatly altered the landscape, but that participants from Mistissini barely mentioned it. Forestry, and the large canopy openings it creates, scare moose away and threaten the survival of calves during the winter (Ausilio *et al.*, 2023; Fisher *et al.*, 2021). This demonstrates how forestry and road construction for the industry have disproportionate consequences on the Abitibiwinnik traditional way of life (Asselin *et al.*, 2015; Badry *et al.*, 2023; Kneeshaw *et al.*, 2010).

In comparison with forestry, fewer Abitibiwinni participants mentioned the effects of mining and hydroelectricity on wetlands as well as on their traditional activities such as hunting and fishing. The two communities, with only one active mine on their territory at the time of the study, are considered to be equally affected by mines. In Mistissini, forestry and mining activities were said to affect a similar proportion of participants, while hydroelectricity appears to have a relatively lower effect.

In both communities' territories, the disturbance caused by roads is equivalent to that caused by forestry, since one does not go without the other, except for one Mistissini participant who mentioned the effects of roads although his trapline is located in the northern part of the

Mistissini territory, where there is no forestry, but where a road network allows to access a mine site. The expansion of the forestry road network has resulted in an increased number of non-Indigenous hunters and facilitated their access to previously inaccessible territories, according to participants from both communities. Increased access to the land through higher road density has been shown before to enhance the potential for conflicts between land users (Kneeshaw *et al.*, 2010). Moreover, the majority of participants believed that the reduction in moose density was a result of overharvesting, made possible by easier access to a larger part of the territory. It is widely acknowledged that the success of hunters is largely facilitated by higher road densities, and that moose avoid areas where forestry operations are taking place (Johnson and Rea, 2023; McKay and Finnegan, 2023) and where road density is high to avoid collisions with vehicles and to stay away from traffic noise (Leblond *et al.*, 2013; Wattles *et al.*, 2018). In addition, not only humans use the expanded road network, but predators as well, especially wolves (Muhly *et al.*, 2019). However, it is difficult to get a clear picture of these effects without a complete database. The data obtained by AQRéseau+ makes few distinctions between the different road classes, in addition to having a high proportion of unclassified roads, which could possibly have an influence on the results (Laurian *et al.*, 2008a; Wattles *et al.*, 2018).

Mining activities also directly affect large wildlife and their habitat. Forest suppression around mining zones, and the noise from drilling and machinery in mining areas result in functional loss of habitats for noise-sensitive mammals (Bhardwaj *et al.*, 2022; Drolet *et al.*, 2016). Mining activities generate long-term degradation, alter the local biodiversity and affect the surroundings of exploited areas (Martins-Oliveira *et al.*, 2021; Yin *et al.*, 2023). Fortunately, the Eeyouch have managed to build relationship with corporations in ways that sustain their enduring political philosophy and to limit the consequences on the Cree way of life (Gauthier and Vanthuyne, 2022).

When combined, human disturbances have cumulative effects which are stronger than their individual effects (Bélisle et Asselin, 2021; Crain *et al.*, 2008; Parlee *et al.*, 2012). Indigenous Peoples have a deep and intimate relationship with the land, which has made them more susceptible to the impacts of environmental change and their health is increasingly at risk (Cloud et Redvers, 2023; Fuentes *et al.*, 2020). Moreover, hunters' food insecurity will certainly increase with climate change, requiring adaptation and resilience skills (Herrmann *et al.*, 2012; McLaren, 2012).

In contrast, one of the participants mentioned that his trapline is located in a protected area where forestry, mining, and hydroelectric activities are not permitted. This participant mentioned no impediment to his engaging in cultural activities, suggesting that protected areas can have a positive effect on preserving traditional practices and ways of life (Champagne-Côté *et al.*, 2023; Ens *et al.*, 2021).

Hunting and fishing in wetlands. Wetlands have been and continue to be integral to Indigenous cultural landscapes in North America (Chasmer *et al.*, 2020; Speller et Forbes, 2022). Participants, mostly from Mistissini, described their use and frequentation of wetlands through a variety of traditional practices, but the most prominent was certainly big game hunting. Large herbivorous species such as moose thrive in both permanent and vernal wetlands (Dixneuf *et al.*, 2021). It has been observed by participants that wetlands have been flooded or drained following the construction of new roads, resulting in the loss of areas once used for hunting or fishing. Greater road density increases wetland fragmentation, in addition to modifying water levels and flow patterns, sedimentation rates, ultimately causing degradation of wildlife habitats (Kneeshaw *et al.*, 2010). It was even reported during the interviews that some remediation work had been done in certain sectors, but that this work had been unsuccessful and that it had never been possible to fish trout again. Participants therefore reported on the importance of keeping sensitive areas protected rather than disturbing them in the belief that remediation work would be sufficient to allow exploitation. It is noteworthy that only men participated in this study. Although the link between wetlands and wildlife habitat is undeniable for hunters, the participation of women could have changed the distribution of activities practised (Basile *et al*., 2017). Indeed, considering their traditional role in the community, we would probably have seen more trapping, gathering and teaching.

Stressful environment for moose? There was no significant difference in the average concentrations of cortisol between the control group (Refuge Pageau) and free-ranging moose. It was expected that the mean of the control group would be significantly lower due to the absence of predation and being in a controlled environment with regular and constant access to food. Although an animal's stress level may increase with the constant presence of visitors (Heimbürge *et al.*, 2019), the animal is able to acclimatize and its stress level decreases over time (Fischer et Romero, 2019). However, with only 5 reference values compared to 33 for free-ranging individuals, it is difficult to draw convincing conclusions. A larger sample size or longer sampling period could allow for more precise analyses, especially concerning age and sex variations (Heimbürge *et al.*, 2019; Terwissen *et al.*, 2013). However, our results (range: 0.65-10.70 pg/mg) are reassuringly consistent with typical average moose hair cortisol concentrations (range: 0.14–15.9 pg/mg) found in previous studies (Keogh *et al.*, 2023; Madslien *et al.*, 2020; Spong *et al.*, 2020).

Geographical analyses were done to validate the effect of environmental stress on moose, particularly by examining the presence or absence of anthropogenic disturbances. The samples collected by the MELCCFP were all from healthy females located north of the northern limit of Québec's commercial forest (Figure 1.1). As a result, road density was low in the sampling area, actually lower than the threshold value of 0.6 km/km^2 recognized as the point at which certain large vertebrate populations begin to decline due to harmful biological effects (Beazley *et al.*, 2004; Forman *et al.*, 1997). This could explain why we did not detect any effect of road density on cortisol levels. In future studies, the same analysis could be carried out in regions with greater disturbance variability to test the hypothesis that anthropic disturbances stress moose.

A single active mine (Stornoway's Renard diamond mine) was located approximately 12 km from one of the samples, for which no anomaly in cortisol concentration was detected. It was therefore not possible to detect any effect of mining on the stress or health of nearby moose. We would have expected, however, an increase in stress in moose near noisy operations such as mines, since acoustic stimuli provoke negative reactions such as flight or reduced foraging time (Bhardwaj *et al.*, 2022).

Initially, the project was designed so that moose hair samples would be collected by Indigenous hunters near the collaborating communities. However, the sampling period coincided with the COVID-19 pandemic, so community visits and access to the territory were restricted. As a result, the samples were collected opportunistically during a moose aerial survey conducted in Eeyou Istchee James Bay by the MELCCFP. However, these samples turned out to be far from the areas initially targeted for analysis due to their higher disturbance intensity.

Cortisol concentrations may be influenced by the body area from which the hair is collected, as well as the humidity level during storage (Macbeth *et al.*, 2010; Rakic *et al.*, 2023). However, MELCCFP technicians ensured that the hair was always collected from the same location (upper shoulder) and that samples were stored properly. The same treatment was done during the captive moose sampling. This source of error is therefore deemed negligible.

Natural causes of stress for moose. If the variations in hair cortisol concentration in our study did not appear to be affected by anthropogenic disturbances, perhaps the cause was natural? Indeed, the number of winter ticks on a given moose was shown to have a significant effect on cortisol concentration. Indeed, it is widely accepted in the literature that tick infestation increases cortisol concentrations in animals (Rosenblatt *et al.*, 2021; Spong *et al.*, 2020). In severe situations, a high concentration of ticks can lead to health issues such as itching, hair loss, anemia, and low weight gain. The body may require a significant amount of energy to replace the blood lost each day, which could further worsen the nutritional status and lead to weight loss (L. Nelson *et al.*, 2023). In addition, climate change is likely to worsen the severity of winter tick infestations in the future (Elzinga *et al.*, 2023). As moose is a fundamental part of Indigenous cultures, its potential decline is a source of great concern to communities and threatens the maintenance of cultural practices (Badry *et al.*, 2023; Priadka *et al.*, 2022). Research into the causes of decline in moose populations is therefore essential, and cortisol measurements can be useful in this regard.

1.6 Conclusion

Wetlands support a unique ecosystem. They are crucial habitats for a diverse range of flora and fauna, providing breeding grounds, nesting sites, and feeding areas for various species. Wetlands also play a vital role in regulating the water cycle, filtering pollutants, and mitigating the impact of floods and droughts. For many Indigenous communities, wetlands hold cultural and spiritual significance, serving as places for recreation, education, and traditional practices such as hunting, trapping, fishing and gathering.

Our results highlighted the importance of wetlands to Eeyou and Anishnaabe peoples. However, the effects of industrial activities on wetlands are often disregarded. The interviews revealed the impact of human disruptions on the traditional way of life of the First Nations in Eeyou Istchee. It is important to give more consideration to wetlands and to gain a deeper understanding of historical and current human-environment interactions in northern North America (Speller and Forbes, 2022). This underscores the need to take the interests of Indigenous communities into account in development projects, and to protect wetlands for both their ecological and cultural values.

Our results also provided baseline moose hair cortisol concentration data, which can be used to develop a non-invasive population monitoring tool. These data are valuable for wildlife conservation and ecosystem management. Additionally, cortisol analysis highlighted the threat of winter ticks to moose populations, especially with climate change. This underscores the need for holistic strategies addressing environmental challenges. Integrating these findings into conservation efforts is vital for protecting wildlife, as well as the traditional way of life of the Eeyouch and Abitibiwinnik in Eeyou Istchee Baie James.

CONCLUSION GÉNÉRALE

Il reste encore beaucoup à apprendre sur les milieux humides et leur rôle central dans l'équilibre du fonctionnement des écosystèmes, surtout que cet équilibre est menacé par la surexploitation des ressources naturelles (Bélisle et Asselin, 2021). Cette étude aura permis de documenter leur apport à la culture des peuples Eeyou et Anicinape. En plus du gibier et du poisson qu'ils abritent, les milieux humides offrent des plantes médicinales, du matériel sanitaire, des matériaux isolants et des plantes et fruits sauvages comestibles. Les milieux humides sont source de vie.

Il est bien ancré dans la culture autochtone que nous devons prendre seulement ce dont nous avons besoin et laisser l'environnement reprendre son équilibre (LaRiviere et Crawford, 2013). Le non-respect de ce principe cause déjà de nombreux problèmes sur le territoire tels que la perte d'habitats fauniques et de biodiversité. Ces effets affectent la capacité des Peuples autochtones à maintenir les activités culturelles sur le territoire, menaçant par le fait-même leurs cultures et leurs identités.

Les défis supplémentaires engendrés par la pandémie ont incontestablement perturbé le déroulement de ce projet de recherche. Initialement, il était prévu une plus grande implication des chasseurs dans ma recherche, comme cela était initialement prévu, notamment par le prélèvement d'échantillons de poils d'orignaux à proximité des sites perturbés mentionnés lors des entrevues. Cela aurait permis d'obtenir un éventail plus large d'échantillons provenant d'individus de différents âges et sexes, offrant ainsi une image plus fidèle de la situation. De plus, les entretiens auraient dû se dérouler en personne sur une période plus étendue, ce qui aurait potentiellement permis le recrutement de femmes et apporté une perspective plus globale sur les milieux humides.

Bien que les objectifs scientifiques de ce mémoire aient été partiellement atteints, mon objectif personnel l'a été pleinement. J'ai réussi à mettre en valeur les connaissances autochtones à travers le filtre universitaire. Ces bribes de connaissances qui ont été transmises de génération en génération, qui ont traversé 1001 époques, qui ont survécu aux traumatismes, se retrouvent finalement dans les lignes de ce mémoire. C'est assez incroyable quand on y pense. Il reste cependant beaucoup de travail à faire pour maximiser l'entrée de ces connaissances millénaires dans la littérature scientifique. Le temps joue contre nous, les détenteurs de telles connaissances se font de plus en plus rares.

La vraie réconciliation passera par la reconnaissance de la valeur des savoirs traditionnels autochtones et leur fusion avec les savoirs scientifiques.

ANNEXE A - CERTIFICATION ÉTHIQUE

.1 Évaluation et délivrance de la certification éthique initiale

UQAT
UNIVERSITÉ DU QUÉBEC
EN ABITIBI-TÉMISCAMINGUE

Le 26 février 2020

Madame Éliane Grant
Institut de recherche sur les forêts
Université du Québec en Abitibi-Témiscamingue

Objet : Évaluation éthique – Projet *« Effets de l'activité anthropique sur l'utilisation par les Eeyou et les Anicinapek des milieux humides de Eeyou Istchee Baie-James »*

Madame,

Étant donné le risque en deçà du seuil minimal pour les participants, le Comité d'éthique de la recherche avec des êtres humains de l'UQAT (CÉR-UQAT) a eu recours le 12 septembre 2019 à la procédure d'évaluation déléguée du projet cité en rubrique, par trois de ses membres, conformément à la Politique d'éthique de la recherche avec des êtres humains de l'UQAT (article 5.5.2).

Le CÉR-UQAT a évalué les modifications apportées au projet pour faire suite aux modifications qui avaient été demandées lors de cette évaluation. Toutes les modifications ont été faites à notre satisfaction et nous sommes heureux de vous délivrer le certificat attestant du respect des normes éthiques.

Je vous invite également à nous faire part de tout changement important qui pourrait être apporté en cours de recherche aux procédures décrites dans le formulaire de demande d'évaluation éthique ou dans tout autre document destiné aux participants.

En vous souhaitant tout le succès dans la réalisation de votre projet, nous vous prions de recevoir, Madame, l'expression de nos sentiments les meilleurs.

Pascal Grégoire, Ph. D.
Président du Comité d'éthique de la recherche avec des êtres humains

PG/bg
p. j. Certificat

c. c. Monsieur Hugo Asselin, directeur de recherche, École d'études autochtones
Madame Nicole Fenton, directrice de recherche, Institut de recherche sur les forêts

Référence : 2019-09 – Grant, É.

UQAT
UNIVERSITÉ DU QUÉBEC
EN ABITIBI-TÉMISCAMINGUE

Comité d'éthique de la recherche avec des êtres humains

Certificat attestant du respect des normes éthiques

Le Comité d'éthique de la recherche avec des êtres humains de l'Université du Québec en Abitibi-Témiscamingue certifie avoir examiné le formulaire de demande d'évaluation éthique du projet de recherche et les annexes associées tels que soumis par :

Madame Éliane Grant

Projet intitulé : *« Effets de l'activité anthropique sur l'utilisation par les Eeyou et les Anicinapek des milieux humides de Eeyou Istchee Baie-James »*

Décision :

☒ Accepté		
☐ Refusé :	Suite aux dispositions des articles 5.5.1, 5.5.2 et 5.5.4 de la Politique d'éthique de la recherche avec des êtres humains de l'Université du Québec en Abitibi-Témiscamingue	
☐ Autre :		

Surveillance éthique continue :

Date de dépôt du rapport annuel :	26 février 2021
Date de dépôt rapport final :	À la fin du projet

Les formulaires modèles pour les rapports annuel et final sont disponibles sur le site web de l'UQAT : http://recherche.uqat.ca/

Membres du comité ayant participé à cette évaluation :

Nom	Poste occupé	Département ou discipline
Nancy Crépeau	Représentante autochtone	
Suzy Basile	Représentante autochtone	École d'études autochtones
Pascal Grégoire	Président du CÉR	UER en sciences de l'éducation

Date : 26 février 2020

Pascal Grégoire, Ph.D., président du CÉR-UQAT

Pour toute question : cer@uqat.ca

.2 Renouvellement de la certification éthique

UQAT
UNIVERSITÉ DU QUÉBEC
EN ABITIBI-TÉMISCAMINGUE

Le 7 avril 2021

Madame Éliane Grant
Étudiante à la maîtrise en écologie
Université du Québec en Abitibi-Témiscamingue

Objet : Renouvellement de l'approbation étique et
Réception et acceptation des modifications au projet

No du certificat : 2019-09 – Grant, É.
Projet intitulé : « Effets de l'activité anthropique sur l'utilisation par les Eeyou et les Anicinapek des milieux humides de Eeyou Istchee Baie-James »

Madame,

Le Comité d'éthique de la recherche avec des êtres humains de l'UQAT (CÉR-UQAT) a pris connaissance du rapport annuel et de l'avis de modifications que vous lui avez soumis le 6 avril 2021 relativement au projet cité en rubrique. Nous vous remercions pour votre diligence.

La lecture du rapport et de l'avis nous a permis de constater l'acceptabilité éthique des modifications apportées au projet et le bon déroulement du projet sur le plan éthique et vous autorise à poursuivre vos activités par le renouvellement de votre certificat pour une période d'un an, soit jusqu'au 26 février 2022.

Dans ces conditions, vous devrez soumettre à nouveau un rapport au CÉR-UQAT l'an prochain. Si d'ici là le projet de recherche cité en rubrique se termine, vous pourrez soumettre un rapport final. Tous nos formulaires sont disponibles sur le site web du CÉR-UQAT :
https://www.uqat.ca/recherche/ethique/etres-humains/

En vous remerciant pour votre collaboration à la surveillance éthique continue de la recherche, nous vous prions de recevoir, Madame, l'expression de nos sentiments les meilleurs.

Maryse Delisle

Maryse Delisle
Conseillère en gestion de la recherche
Comité d'éthique de la recherche avec des êtres humains
Université du Québec en Abitibi-Témiscamingue
cer@uqat.ca

MD/bg

c. c. Pr Hugo Asselin, directrice de recherche, ÉÉA
Pre Nicole Fenton, directrice de recherche, IRF

ANNEXE B - GUIDE D'ENTREVUE

.3 Version anglaise.

Use of Wetlands Survey

Name:____

Traditional activity practicing:

☐ *Hunting:*____________________________________
☐ *Fishing:*____________________________________
☐*Trapping:*____________________________________
☐*Crafting:*____________________________________
☐*Medicine:*____________________________________
☐*Dancer:*____________________________________
☐*Berry picking:*______________________________
☐*Teaching:*____________________________________
☐*other:*______________________________________

Type of wetland **found** on the territory:

____
____
____

Type of wetland **used** on the territory (for traditional activity or other):

____
____
____
____

Evolution of wetland in time (condition, use, modification,…):

____
____
____
____

Cause of changes (climate change, industrial, demographic, natural,…):

____

Effect of anthropic disturbance:

Effect of disturbance on traditional activities practice:

Gender: □*Female* □*Male*

Age:

Location:

Occupation:

Status: □*Tallyman* □*Family* □*Land user* □*other:*

.4 Version française

Questionnaire Milieux Humides

Nom:______________________________

Activité traditionnelle pratiqué:

□ *Chasse:*______________________________
□ *Pêche:*______________________________
□ *Trappe:*______________________________
□ *Artisanat:*______________________________
□ *Médecine:*______________________________
□ *Danse:*______________________________
□ *Cueillette:*______________________________
□ *Enseignement:*______________________________
□ *Autre:*______________________________

Type de milieux humides **présent** sur le territoire:

____
____
____

Type de milieux humides **utilisés** sur le territoire (pour les activités traditionnelles ou autre):

____
____
____
____

Évolution des milieux humides dans le temps (condition, utilisation, modification,…):

____
____

Cause des changements (changement climatique, industriel, démographique, naturel, …):

____

Effet des perturbations d'origine humaine :

Effect des perturbations sur la pratique des activités traditionnelles :

Commentaire :

ANNEXE C – MATÉRIEL SUPPLÉMENTAIRE

Table S1: Shoulder hair cortisol concentration of moose from free-range (FR) and refuge (REF) in Eeyou Istchee areas collected in winter of 2019 and 2021.

IDAnimal	Sex	Collection Date	Cortisol (pg/mg)
FR01	F	20210214	1.76
FR02	F	20210214	2.29
FR03	F	20210214	0.92
FR04	F	20210214	1.46
FR05	F	20210215	0.65
FR06	F	20210215	2.61
FR07	F	20210215	1.73
FR08	F	20210215	1.86
FR09	F	20210216	1.50
FR10	F	20210216	1.85
FR11	F	20210216	0.93
FR12	F	20210217	2.16
FR13	F	20210217	1.80
FR14	F	20210217	2.38
FR15	F	20210217	1.45
FR16	F	20210217	1.41
FR17	F	20210218	3.13
FR18	F	20210218	1.79
FR19	F	20210218	10.70
FR20	F	20210218	1.56
FR21	F	20210219	2.20
FR22	F	20210219	1.28
FR23	F	20210219	1.60
FR24	F	20210219	2.55
FR25	F	20210220	1.76
FR26	F	20210221	1.16
FR27	F	20210221	2.19
FR28	F	20210221	2.01
FR29	F	20210221	1.88
FR30	F	20210222	1.80
FR31	F	20210222	1.60
FR32	F	20210222	1.48
FR33	F	20210317	1.92

REF01	M	20191210	3.19
REF02	F	20191210	3.59
REF03	F	20191210	1.66
REF04	M	20191210	1.98
REF05	M	20191210	4.23

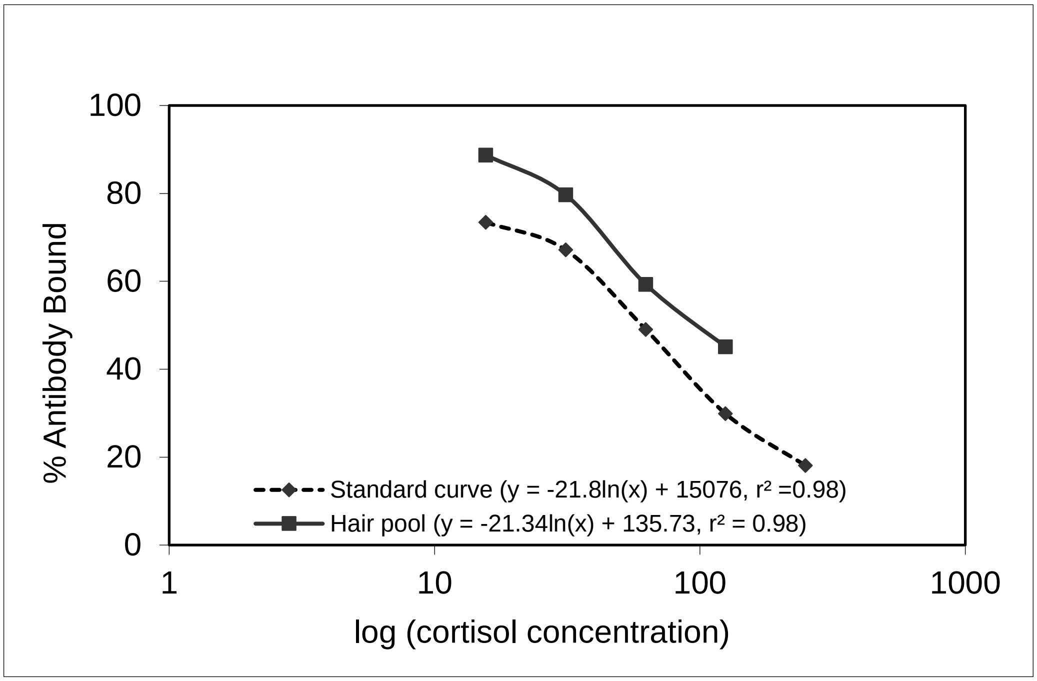

Figure S1: Results from linearity assessment of cortisol enzyme immunoassay (EIA) with moose hair extracts.

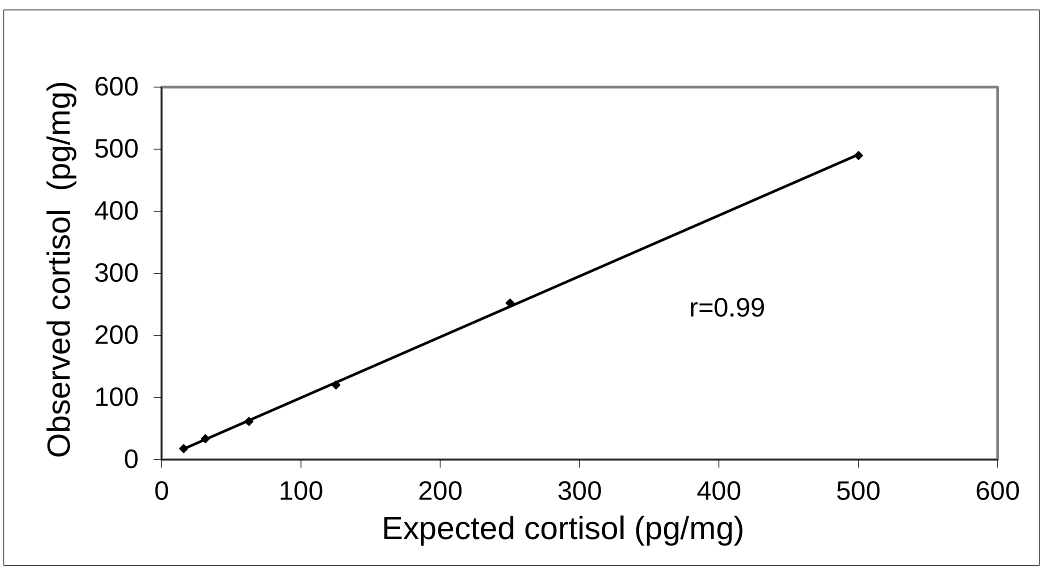

Figure S2: Linearity of response of a pure cortisol standard after serial dilution evaluated at 102.2% ± 2.6 [mean ± SE].

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