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Significance of affect and ethics in applying conservation standards: The practices of flying squirrel surveyors

Abstract

We examine human-animal encounters as the generative source of affective knowing and learning to study the role of affect in the implementation of nature conservation. The study is based on ethnographic research following the embodied practices of biological field surveyors working with Siberian flying squirrels (*Pteromys volans)* in land use planning in Finland. The case is characterized by radical uncertainties due to the elusive life of flying squirrels, the strict conservation standard of the EU, and the pressure of urban development. The surveyors can use only indirect clues to detect these nocturnal animals, but are required to produce accurate and unambiguous ecological knowledge to planners. We found that affective learning enables knowing and increases the reliability of knowledge in such conditions. Affective learning results from alternation between constant encountering of clues and changing intensities that produce feeling states and a sense of the forest where the animals live. Ethical consideration and personal differences are important in affective learning and shape the surveyors as participants in standard development. Finally we discuss the possible implications of affective learning for standard design in nature conservation.

Keywords: affect, ecological knowledge, ethics, land use planning, nature conservation, standard

Highlights

- Biological field surveying creates fine-tuned and complex embodied practices
- Affective human-animal interaction can be based on clues to the animal
- Strict standards in conservation work better through affective learning
- Affect, ethics and standard define a new research field for sustainability
- Field surveyors gradually shape and become shaped by the conservation standard

1 Introduction

Global concern over biodiversity has led to a growing need to apply standards in conservation. Derived from red data lists, legislation and scientific knowledge, standards are a trademark of modern conservation; they specify what has to be conserved and how (Adams, 2004; Haila, 2012). In our present case study, conservation of "breeding sites and resting places" is a standard that is being applied through the Habitats Directive in Europe over a very wide range of animals listed in the annex of strictly protected species, from wolves, flying squirrels and loggerhead sea turtles to species of spiders and molluscs (European Council, 1992; Environment DG, 2007).

While conservation standards are expected to offer efficient solutions in policy implementation, they are in constant contradiction with local particularities. This basic dilemma of conservation is frequently faced by biological surveyors who are responsible for collecting accurate field data on endangered animals. First of all, they face epistemic uncertainties when defining sites and boundaries for conservation. As animals move and hide, conclusions on presence and absence must be made on the basis of fragmentary and often indirect data (Bear and Eden, 2011; Eden and Bear, 2011; Ellis and Waterton, 2004, 2005; Hinchliffe et al., 2005; J. Lorimer, 2006, 2008; Nutch, 2006; Roth and Bowen, 1999; 2001). To make standards work, the field surveyors have to adjust and improvise – only in an ideal world do standardized processes invariably work in the same way (Bowker and Star, 1999, pages 157–158). On the whole, the field surveyors have intimate knowledge of uncertainties that are well-known in social and political studies of standardization (Bowker and Star, 1999; Gerst et al., 2005; Williams and Edge, 1996) but often neglected in the conservation discourse (Regan et al. 2002). The context of standard implementation is totally different from negotiations on standard development conducted in arenas of policy-making.

In this paper we analyse the dilemma between standards and local uncertainties in nature conservation by examining an extreme case, the work of flying squirrel surveyors in Finland. The surveyors are key actors in implementing the conservation standard of this endangered animal species, the Siberian flying squirrel (*Pteromys volans)* (hereafter flying squirrel). In particular, we use an ethnographic approach to follow their working practices in the forest. Evidence and unambiguity are required of the surveyors even if there are only fragmentary and indirect data available. The surveyors work in areas where flying squirrels have given rise to severe conflicts in land use planning and forest management. In addition, the following characteristics of our case make it particularly fruitful for analysing epistemic problems related to standard implementation and affect in highly uncertain circumstances: 1) the flying squirrel is exceptionally elusive and very seldom sighted in the wild while surveying; 2) the pressing need for accurate and unambiguous information of the whereabouts of flying squirrels is caused by the context of land use planning constrained by a strict conservation standard; and 3) the very survival of the flying squirrels is at stake in every survey case – conservation decisions are based directly on the observations of the field surveyors. Focusing on their expertise and practices of knowing we ask: what is the role of affect in making conservation standards work under high uncertainties?

J. Lorimer (2008) studied affective relationships between humans and animals in field studies but conservation standards are not the primary focus of his study, and in general the relationship between affect, standards and uncertainties is underexplored in research. Often standards are taken as given facts, forgetting that keeping them in operation needs constant work and adjustment. All standards are socially constructed, as they are outcomes of negotiations and shaped by social, political and economic interests. The ecological relevance of conservation standards varies (on conflicts, see e.g. Cardoso, 2012; Larson, 2007). In local implementation, mere technical, legal or economic rationalities do not work, because a standard has its own context, depending on the actors

involved, the organizational culture and many other factors (see Alphandèry & Fortier 2010). The role of affect becomes particularly interesting in cases with political pressure and radical uncertainties. Surveyors draw on affectual capacities in order to produce standard compliant evidence from uncertain sightings of an elusive species.

In the next section we build our conceptual framework on the basis of affect research. After that, in the empirical part of the paper, we present a detailed analysis of knowledge practices of the flying squirrel surveyors, and we also recognize personal differences and the ethical dimension of affective knowing. We conclude with notions on affect and ethics, how they become critical factors when applying conservation standards in highly uncertain circumstances, and how the role of field surveyors as biodiversity experts should be understood in such circumstances.

In addition to affect research, our study is informed by science and technology studies. In this field, there is much research on standards and uncertainties (e.g., Bowker and Star, 1999; Latour, 2005). Concerning the development of standards, mutual shaping between technology (nature conservation) and its environment is an important standpoint. In this view, technology can be understood as a social product, patterned by the conditions of its creation and use (Williams and Edge, 1996). Obviously then, there is a range of choices possible at every stage of the standardization process (Gerst et al., 2005). In our case, the choices are influenced by affective encounters between field surveyors and flying squirrels, making conservation a sociomaterial process.

2 Affective encounters

Since the affective turn in social science studies, the concept of affect has recently been applied in many disciplines. Affect arises from a relation; it is a force of encounter, an effect of that relation. It arises from in-between, from the indeterminacy and ambiguities that are typically present in encounters, and serves as a force that puts us into movement (e.g., Anderson, 2006; Pile, 2010; Gregg and Seigworth, 2010).

Although there is no single theory of affect, different orientations within affect research lay emphasis on force relations and capacities to act. This focus of research originates from Spinozian thinking, taking the view that affect is a "transpersonal *capacity* which a body has to be affected (through an affection) and to affect (as the result of modifications)" (Anderson 2006, page 735, emphasis original). Affective encounters involve "the transfer of power from the affecting body to the affected body and so invest that body with joy and an increase in its power of acting" (Duff 2010, page 885, following Deleuze). Note, however, that there is no guarantee of affect leading to a positive result, negative outcomes are also possible. The core idea is that the more power we have to be affected, the more power we have to act, and transpersonal capacity arises from body-to-body relations. However, the body does not need to be human-to-human but can include both human and nonhuman actors, objects, and processes (Thrift, 2004; Gregg and Seigworth, 2010, page 2).

For us, affect is a force which increases the capacity of flying squirrel surveyors. Affect is based on movement; it is a process between the surveyor and the surveyed. It originates from the encounters between the surveyors and the clues to flying squirrels they can perceive in the forest. We consider that actions and conscious thoughts of the flying squirrel surveyors result from pre-conscious thought shaped by their experiences with clues. The relationship between survey practices and the situated environments shapes the emergence of the human-to-nonhuman body. In this sense, the

body and the sense of embodiment can be understood as a process that always come into being in conjunction with the environment during the survey (see Macpherson, 2010, page 4).

We analyse how affect arises from encounters, simultaneously as intimate and impersonal, and how it accumulates across both relatedness and interruptions in relatedness (Seigworth and Gregg, 2010, page 2). In particular we follow how the surveyors gain or lose their affective capacity through the intensities and resonances they experience during the series of encounters with different clues to flying squirrels. We combine the approaches of Seigworth and Gregg (2010) and Duff (2010, page 885) to explore this process from two perspectives: (1) how the surveyors are in relation to the flying squirrels, or better, how different clues to flying squirrel mediate – through affect, feelings states and personally developed practices – this relation for each surveyor in specific situations, and (2) what kind of passage of forces (intensities) emerge from these encounters and what kind of capacities and practices they afford?

For analyzing the surveyors' practices in knowledge gathering, we focus on knowing and learning enabled by affective relationships between surveyors and flying squirrels. From a Deleuzean point of view, affective knowing and learning happens through interaction in a world which is constantly becoming, and then thinking and doing work simultaneously in a specific context, which actually means that "knowing proceeds in parallel with the body's physical encounters, out of interaction" (Thrift, 2004, page 61). Affective knowing (J. Lorimer, 2008, Thrift, 2004, page 70) demands that the surveyor must become affected by the animal and its environment to be able to obtain knowledge of it. If the surveyors learn to become involved with the flying squirrel and to encounter and embrace it through practice, they will be able to make case-specific interpretations of the encounters. In the learning process, affect can be regarded as a pre-cognitive flow emerging between the surveyor and the animal and giving the surveyor the potential for training the capacity

of the body in the survey work. As Hardt (2007, page x, following Spinoza) points out, affective learning is not far from ethical and political aspects: although reason and passion are not the same, they form a continuum, and "the ethical and political project involves a constant effort to transform passions into actions".

Affect differs from two other concepts in our study, namely emotions and feelings. Affect is the capacity to relate and the capacity to do something; its emergence from the relation between bodies makes it different from expressions such as emotion and feeling (Anderson, 2006, 2009). Feelings are momentary expressions of the movements of affects, and emotions are intimate, distinctly personal ways of being through which the affectual is experienced (Anderson, 2006, pages 736–737, see also McCormack, 2006, Thien, 2005). Duff (2010, page 884, paraphrasing Thrift, 2004) clarifies the conceptual difference: "Affect describes an array of feeling states characteristic of everyday life, with its constant shifts in mood and emotional resonance", but "individuals typically remain uncertain, even unconscious, of the particular character of individual affects and their provenance. Yet one cannot help but feel moved by one's affects, in that one experiences affective responses even if one is not able consciously to describe or explain them."

Practically we analyse (1) the various human-animal contexts the field surveyors face in each survey task, (2) the choices open to them when they are working in highly uncertain circumstances, and (3) the relationship between the evolving standard and the individual field surveyors becoming more skillful as they learn in the field. As a methodological implication we take into account that these tasks cannot be performed using mere interviews; careful observation methods are also needed (see H. Lorimer, 2006). This is because, first, affect works within the pre-cognitive area of human conduct and only emotions may be associated with reflexive practices (see Pile, 2010; Anderson, 2006). Second, we are exploring the surveyors' "microkinetic knowledge" through

which they are able to learn to know the landscape and the flying squirrel - this knowledge depends on movement through affective relations and involves both non-intentional action and subjective impression difficult or impossible to verbalize (Macpherson, 2010).

3 The case

3.1 The Siberian Flying Squirrel in Finland

The distribution of the Siberian flying squirrel extends throughout mixed, spruce deciduous forests from Finland and Estonia in the west to the Pacific Ocean in the east (Reunanen, 2001). Flying squirrels are adapted to a mosaic of forest patches (Selonen and Hanski, 2004) but they do not live only in rural areas. Their home range may include urban parks, forested recreation areas in cities and even private gardens, as long as the habitat as a whole is large enough and of sufficient quality. Flying squirrels usually nest in tree cavities made by woodpeckers, but they also use twig dreys made by red squirrels, nest boxes and even buildings. Flying squirrels, being nocturnal, also rest for the day in these places. Deciduous trees, especially aspen, birch and alder, are important food resources for the species.

The flying squirrel became an object of stringent biodiversity policy after it was included in the annex of strictly protected species (Annex IVa) of the Habitats Directive (Council Directive 92/43/EEC) during the EU accession negotiations of Finland (accession taking place in 1995)[1]. The

[1] The flying squirrel was proposed by Finland and added to Annexes IV and II because the annexes were previously lacking Nordic fauna. On its conservation history in Finland, see Haila et al., 2007. The species was already protected by the Finnish legislation since it was classified as an endangered species (categorized as vulnerable) because of its decline rate, observed in local studies. The reason for the endangerment is mainly commercial logging practices that have decreased suitable habitat availability and size (by homogenizing forest structure and decreasing the amount of old deciduous trees) (Rassi et al., 2001).

key paragraph of the strict protection of these species in article 12 prohibits the *deterioration or destruction* of all of their *breeding sites or resting places.* Despite the conservation status, the species is fairly common in the southern and central parts of Finland. The census estimation of the total population is 143, 000 females (Hanski, 2006), although the estimate has subsequently been contested (Sulkava et al., 2008 and the response Hanski, 2008). The species, however, is still classified as vulnerable (Rassi et al., 2010).

The first conflicts over flying squirrel conservation were local logging conflicts in south-west Finland in the late 1990's. The first severe flying squirrel conflicts in urban land-use planning started in 2000. Sudden observations of signs of flying squirrels in the middle of a planning process threatened to halt, or indeed did halt some planning projects (Haila et al., 2007; Nygren, 2005). For example, it was estimated that modifying the motorway plan in Southern Finland because of the flying squirrels in 2004-2008 eventually cost approximately 10 million Euros (Eranti, 2008, page 131). In all, there were dozens of land-use planning conflicts over flying squirrel conservation for several years, extending throughout its area of distribution in Finland (Haila et al., 2007, pages 49-54), and they continue notably in urban land-use planning.

The requirements of the Habitats Directive are further specified in Finland by the Nature Conservation Act (20.12.1996/1096) and supported by the Land Use and Building Act (132/1999), in which the promotion of biological diversity and other natural values was added as one of the objectives of land use planning. The Act also states that 'the plans must be founded on sufficient studies and reports' and that the impacts must be 'assessed to the necessary extent', which means that the ecological knowledge base of the plans must also be strong (Suvantola, 2006). As a result of these two acts, and originally the Habitats Directive, flying squirrel surveys have become a necessary procedure in land use planning in Finland.

3.2 Flying squirrel surveying and the surveyors

The Siberian flying squirrel as a small, nocturnal species living most of its life high in the trees does not make it easily detectable for diurnal humans, walking on the ground (see J. Lorimer, 2006, page 549). Thus the surveyors must rely exclusively on hints of flying squirrel presence. We have tracked the development of the flying squirrel survey method.

Using the distinctive yellowish faecal pellets as a clue of flying squirrel presence was already mentioned in 1978 (Skarén, 1978). In 1993 tracks in the snow and faeces were mentioned as signs of the animal in a biological field survey guide by the Ministry of the Environment (Heikkilä et al., 1993). But it was not until the first years of 2000 that looking for faeces became the established method. This change is illustrated by the Ojala land use planning case in Tampere – in 1999 the first flying squirrel field survey of the planning project was carried out using a different method based on habitat suitability (instead of finding faeces). This method however proved too inaccurate and unreliable, as in 2002 the already approved Ojala master plan was returned to preparation because of new findings of flying squirrels in the central building areas of the plan (Haila et al., 2007, pages 52–54; Nygren, 2005). Subsequent surveys have used the faeces method.

The ecological research literature on the flying squirrel has also grown significantly, especially from 2000 and has shed light, for example, on flying squirrel habitat size and use (Hanski et al., 2000; Hurme et al., 2007b; Reunanen et al., 2002), movements (Desrochers et al., 2003; Hanski et al., 2000; Hanski, 2009; Hurme et al., 2008a;, Selonen et al., 2001; Selonen and Hanski, 2003; 2004; 2010) and conservation (Hurme et al., 2007a; 2008b; Kurttila et al., 2002; Pukkala and Kurttila, 2003; Reunanen, 2000; Vierikko et al., 2010).

In 2003 a guide on biological field surveys and impact assessments for land use planning was published by the Finnish Environment Institute (Söderman, 2003), which also included detailed instructions on flying squirrel surveying. According to these instructions, forest patches inhabited by flying squirrels can be found by looking for flying squirrel faeces at the bottom of trees, and based on these findings and the forest structure, important areas for the flying squirrel should be drawn on a map. In 2004 a national guide was published on how to take the Habitats Directive species into consideration in land use planning (Sierla et al., 2004). In 2003 Finnish Supreme Administrative Court ruled that faeces are evidence of flying squirrel presence (e.g. Finnish Supreme Administrative Court, 2003:38).

In 2005 the Ministry of the Environment issued official guidelines for taking flying squirrels into account in land use planning. According to these, flying squirrel 'breeding sites and resting places' must be surveyed and delineated as accurately as possible when a land use plan would change the land use of an area that is suitable for flying squirrels (Ministry of the Environment, 2005). Essentially, the surveyors are expected to produce a reliable and unambiguous map of current presences of flying squirrels in the planning area.

Biological field surveying can nowadays be studied in several vocational schools in Finland, and the flying squirrel is one of the many species addressed. Although education and the abovementioned guides and instructions may initially be helpful, there is no other way of becoming a surveyor than learning by doing, and developing one's own, embodied survey practice. The work itself is also continuous learning by doing, fine-tuning the skills and practices (see J. Lorimer, 2008; Roth and Bowen, 2001). There is no official certification system for becoming a biological field

surveyor in Finland, so surveyors must create their own credibility as a surveyor through education and/ or experience.

3.3 Surveying the surveyors

The flying squirrel surveyors we studied had acquired their skills and practices largely on their own. They all share an enthusiasm for nature, most of them having a background in amateur ecology, and some of them had later taken a university degree in biology (Table 1). They had learned the general field skills at an early stage, but flying squirrel surveying, and especially becoming attuned to it, adopting fluent practices and becoming expert has required learning in the field. The flying squirrel surveyors can be described as a community of practice, sharing "understandings concerning what they are doing and what that means (…)" (Lave and Wenger, 1991, page 98).

This learning in the wild is what we have investigated by getting to know six flying squirrel surveyors and following their survey methods in detail. We used an ethnographic approach (J. Lorimer, 2008; H. Lorimer, 2006; Nutch, 2006; Roth and Bowen, 1999; 2001) and followed six surveyors on foot, one at a time, when they were working on real cases in the forest. The field trips took place in spring 2005 and on average, they lasted at least 1-3 hours in the field with each surveyor. These people worked as surveyors mainly in the Pirkanmaa region in south-western Finland and had diverse backgrounds (Table 1). We usually visited one site per surveyor; most of the survey tasks we participated in were related to urban planning in the Tampere City Region which is one of the fastest growing urban areas in Finland and therefore susceptible to conservation conflicts in land use. We also utilized office interviews with three of the surveyors which had been conducted for an earlier study (Nygren, 2005).

By exploring their practices attentively, our aim was to find out how they face and manage uncertainties, how they comb the forest to find clues, how they simultaneously generate ecological knowledge and adjust the conservation standard, and how they finally define the presence of the animal to draw boundaries on the map for conservation. Our method consisted of a combination of walking, interviewing and observing (Kusenbach, 2003), which allowed us to adopt the role of curious novices in the forest following an experienced surveyor (Hammersley and Atkinson, 1995). From the viewpoint of adopting such a role without being drowned by a myriad of details of the phenomenon studied, it proved to be helpful that we both knew the main features of surveying practices in advance, and one of us actually had personal experience of biological field survey work, the flying squirrel included.

The field trips mostly took place during an ideal flying squirrel surveying period in spring. We asked the surveyor to follow the usual surveying procedure despite having one or most often both of us following his/her work. We made notes on our observations, taped the discussions, and on some field trips we took photographs. While walking behind or beside the surveyors and sometimes intently watching the bases of trees and the cavities in standing trees together with them, we made observations about surveying routines such as the routes the surveyors chose, the details they kept an eye on, etc. Our interviews were conversational, and frequently we asked detailed reasons for the decisions the surveyors made and the choices available. Each field trip took a couple of hours, and towards the end of the trip we asked the surveyor more general questions about surveying, methodology, learning, uncertainties, her/his own career and personal experiences as a surveyor.

4 Working with flying squirrels

4.1 A sense of the forest, an eye for the faeces

Surveying flying squirrels entails focusing attention simultaneously on several different aspects and scales of nature – forested landscape, distinct forest patches, stand-scale forest structure, individual trees, faecal pellets, possible nest sites. Surveyors use different tools to get to flying squirrel habitats. First they need a car and a map of the area to be surveyed. When the planning area is large, they roughly delimit it for the survey using maps, aerial photographs and their own knowledge of the region to exclude environments that can be regarded as unsuitable, such as open fields, densely built-up areas, lakes, pine forests, sapling stands and clear cuts. Previous flying squirrel observations are important background information for surveyors. These can be obtained, for example, from local amateur naturalists or from the regional environmental authority, which maintains an official database of flying squirrel observations. Surveyors may also use forestry planning data, drafts of land use plans and data from other biological field surveys as additional material.

Superficially it seems easy to guess the right site. We found that the surveyors have different 'working theories', conceptual images of a potential flying squirrel habitat. For example one of them told us he looks at the profile of the forest against the sky and heads for the tall aspen groups, another said that the flying squirrels are found in uneven forests with thickets. They sense the suitability of the forest at a glance, intuitively. When asked, they were able to verbalize their image of the typical flying squirrel habitat. This is not surprising since in their work they also need to disseminate information about the flying squirrels and their habits and habitats. The images described varied, but they had a common core in which a typical potential habitat was (1) a mixed forest with mature spruce and some deciduous trees, preferably aspen, (2) providing cavities, twig dreys or nest boxes for breeding and resting, (3) possibly including distinct feeding areas with deciduous trees, and also (4) forested corridors linking the important subareas within and between

home ranges. This core image corresponds to the conservation guidelines, descriptions in the literature, and judgments made in the courts.

However, until they achieve a level of real expertise and intuitive knowing about flying squirrel life, the surveyors have a history of explorative working with flying squirrels in different conditions. Expertise depends on the depth of human-animal interaction (cf. Roth and Bowen 2001, 471, 479) and can be achieved by the surveyors, if they learn to be affected by the flying squirrel and the forests that they share. The flying squirrel itself keeps hidden from sight, hence there is no option but to learn the clues that hint at presence. Such ambiguity may serve as such an important source of affect (Anderson, 2006).

The most important clues are faecal pellets. Faeces are the most reliable indication and the central evidence - equivalent to what Hinchliffe et al. (2005, page 647) call 'water vole writing'. But to find their way to the minuscule pellets, they first need to narrow down the searched area – identify suitable forest patches from the rest of the forest, and within these patches, identify potential "pellet trees" (under which faeces can be found) from the rest of the trees. Surveyors follow the biggest spruce and aspen trunks and check beneath them to find the faecal pellets. Surveyors' working within a forest patch can be described as a full-bodied immersion in the forest, walking zig zag inside the forest patch, simultaneously assessing the suitability of the parts of the forest for the flying squirrel, pinpointing potential trees and bending down and squinting to look for the faeces.

The winter diet of the flying squirrel makes the faeces yellow-brown and thus easier to find, therefore the established period for conducting reliable surveys extends from February to June. During that period other conditions are also favourable – fresh snow, falling leaves or growing vegetation do not cover the pellets. Sometimes, however, planners or decision-makers disregard the

reliable survey period, and the surveyors have to make extra effort to find the faeces (the surveyors resented this; for them following the reliable survey period was an ethical question). But even in favourable conditions finding the pellets, the size of a rice grain, requires a special kind of focus of observation, an embodied skill impossible to acquire except in the field. In practice, the eye of the surveyor has to get used to the shade of the pellets before finding them, as in the search for wild mushrooms, for example (Fine, 2003, pages 102-104) or in classifying grass species (Waterton, 2003, page 120).

We found different ways to attune to the flying squirrel and its habits and habitat. Some of these manifested as survey practices and awareness of flying squirrel life unknown in the literature. What was particularly interesting in practices was that we also discovered personal differences in finding, using and interpreting different clues. For example, some (but not all) surveyors made extensive and detailed interpretations of the home range and the behaviour of the animal according to the location, quantity and quality of the faeces found – they "became-flying squirrel" (see J. Lorimer 2008, 384; Deleuze & Guattari 1987). Here one of the surveyors explains us at what point he was in surveying when we joined him:

> […] And now the next task is… to try to […]judge if this is a nesting site… There aren't so many fresh [faeces] here, they are clearly from last winter, so this is at least a permanent feeding place, there were clearly tracks, heading that way, where I found a pile [of faeces]. And um here should be the arch; is it the male then which marks the territory? [The size of the arch] varies, usually it's up to 200 metres […] around the spruce trees, and […] one phase is to find the feeding areas, they are probably by the edge of the forest or along that ditch then […]

Here the surveyor tries to imagine the life world of this individual animal, where it nests and eats, and how it marks its territory with faeces. The surveyor's expression of the arch - piles of faeces forming a circular pattern around the nesting tree which the surveyor construed as territorial marking - was a unique interpretation among the surveyors. Also, in addition to faeces as signs of presence of the animal, some of the surveyors had learned to note urine marks and even smell them on the tree trunks and used these as an additional clue to the flying squirrel.

As we walked with the surveyors we also walked how they walked and looked where they looked. We found that some signs were quite easy to learn to see. Finding faeces at the bases of large trees was not difficult, and checking for faeces even became something that the first author started to do on free time while walking in a suitable forest for other reasons. In contrast, distinguishing holes in aspen trunks, finding twig dreys in thick spruce trees, seeing or smelling the urine marks, or finding the dark summer faeces was something that would have required much more field experience than what we got during these visits.

The above mentioned differences in survey practices indicate that the surveyors had gained personal capacities from encounters with flying squirrel and further developed them by getting more affected in their survey practices. This leads to tighter interpenetration between clues and survey practices, resulting in constant shaping of this human-nonhuman body and the surveyors to become more experienced and skillful in their own personal ways. By becoming affected by the sites possibly inhabited by flying squirrel the surveyor, simultaneously, contributes to the ongoing co-constitution of self and site (Duff, 2010; Macpherson, 2010). Actually the site is always constituted by networks of clues that are inevitably relational, as they indicate different combinations of presence/absence and thus different affective intensities.

Personal variation suggests that affective learning is a central part of survey practices. The living interface between surveyors and clues serves as an unfailing source of learning, producing diverse encounters, each of them generating unique affective capacities for surveyors. One of the surveyors told us his own application to become productively affected by the diverse contexts in the forest and thus gain more experience of the flying squirrel. He searches for clues not only in typical habitats of the animal, but also passes through unlikely areas thereby keeping himself responsive to surprises. He was worried about the routinization of survey practices because, as he explained, routines repeat the same and may hamper surveying and learning. This reflection demonstrates the interaction between affect and learning in survey practices. Although routines, while mostly operating under the influence of affect within the pre-reflexive sphere, always include the aspect of creative improvisation; routines do not constrain conscious reflexivity of the practices. By becoming affected by exceptional cases and the animal-related intensities they entail, the surveyor can experimentally intensify the body's power of acting and learning.

In addition to affective intensities and the capacities they build, it is necessary to look at states of feeling. Among the surveyors, positive feeling states refer to changing situations that give them emotional motivation through passion and hope. It comes through in our data that hope of finding the animal is a constant feeling of the surveyors. In linguistic expressions it typically assumes an emotional tone, as here on a field trip with a surveyor when we found no faeces:

> Too bad, that we're not finding anything […] Although of course I should be objective [but I get a] a feeling of disappointment if I find nothing. (Surveyor 1)

A hope of finding the animal merges with the passion for tracing it:

> My colleagues laugh at me, even on a spring trip of our department I had to jump out of the car and see if there were [faeces] under a tree, and there were. It is at the same time a hobby and one enjoys it. You get a feeling of success, if you find them. Also, when I was spending Midsummer at my friend's country cottage, there, too, I had to, I was looking, like, 'hey, that spruce looks quite good, and there are quite big alders on the shoreline'… If there are [flying squirrels] in this area, then there could be [faeces] under that spruce – and there were… (Surveyor 6)

The surveyor was so affected by the site that he could not help but check it. This shows how affects, emerging from various encounters, are experienced in bodies during the survey work. Survey work is an embodied practice, not only as regards the epistemic intelligence gained by affective capacities but also in the sphere of feelings and emotions.

The episodes above also illustrate that the surveyors need attunement (affection) to flying squirrels in two distinct scales. The surveyors should train their eyes to read the faeces and other detailed clues in the forest, and at the same time they should gain experience to acquire a sense of the forest where the flying squirrel probably lives. These two scales are two distinct contexts for affects to emerge, but in the work of flying squirrel surveyors they interact. When they interact, they form a "*circle of affective learning*" which propels the surveyors to negotiate the forest more intensively. If the pellets are found, the habitat really is suitable and entails a new variation of intensities as affect accumulates across different contexts and links clues together somewhere else. Similarly to affect in place-making (Duff, 2010, page 892), these two scales do not totally merge. Surveyors are affected by the forest before they may be affected in that forest through their practices with details – a sense of forest becomes first and reveals the site for a rigorous survey.

4.2 Probing the core

Since the surveyors' task is to delineate the 'breeding sites or resting places' of the animal, it is not enough to find faeces in the right habitat; they need to establish which parts of the forest patch *exactly* are important for the flying squirrel – they need to look at the forest with "the eyes of the flying squirrel". Pressured by administrative guidelines and planning practices, the surveyors need to find *evidence* that nesting and resting is possible, the locations of potential nesting places. These are woodpecker cavities, twig dreys and nest boxes. This is far from being an easy task – not only is the animal elusive but so are its nests. Flying squirrels use several nests in their home range by turns (Hanski et al., 2000). Woodpecker cavities are usually several metres high in aspen or other trees, and the surveyors used binoculars to spot the holes. A sharp eye is needed to distinguish them from other dark spots, bumps and scars on the trunk, and to judge if the hole could be the right size for the flying squirrel. The twig dreys are even more difficult or downright impossible to spot from the ground because they are always high up in dense spruce trees. The problem is that a surveyor can never be sure of having found all or even the most important nesting places in a forest or to be sure that they are, actually or potentially, used by flying squirrels[2].

Nest boxes hung low on the tree trunks by birdwatchers are much easier to check for signs of flying squirrel habitation. The boxes are not hard to spot, and the surveyors may also ask local birdwatchers the location of suitable boxes and observations of flying squirrels in them. But nest boxes pose a different kind of problem for the surveyors: can the human-made nest box be a legally

[2] Definitive proof of flying squirrel presence - seeing the animal or nest material used by it - could only be obtained by looking inside. But climbing to check cavities and dreys would be impracticable, dangerous, time consuming and also forbidden – disturbing the animals is prohibited. Among our informants only one surveyor had done this in a very controversial planning case.

protected breeding site or resting place for the flying squirrel or does the nest box jeopardize the whole survey?[3]

The nesting place is the functional core of the flying squirrel's home range, and formulated as a 'breeding site or resting place', it is a fundamental part of the conservation standard. However, nesting places are relational in survey practices and the surveyors deal with them together with faeces and habitats (forest quality) when making conclusions on the boundaries of a flying squirrel site or the presence/absence of the animal. Nesting places are specified by clues and belong to dynamic surfaces against which affects arise in survey practices.

Nesting places cannot be the only clues to flying squirrel and to the 'breeding site or resting place' for another reason, namely the surveyors' habit of improving their skills and working theories on several scales at the same time. While frequently working with clues and core habitats, they gather experience and affective capacity from landscapes and regions. They have been among the first to realize that the flying squirrel, an animal previously regarded as a typical resident of remote wilderness areas, can be regularly found in seemingly low-quality habitats close to human habitation. Much of the surveyors' field knowledge is absent in the literature, environmental administration and guidelines for conservation. For instance, one surveyor told us about their observations that flying squirrels on the west coast live in pine-dominated forests, which they avoid elsewhere:

[3] This doubt may have arisen because the original wording of the Finnish Nature Conservation Act (20.12.1996/1096), differing from the Habitats Directive, emphasized that only breeding sites or resting places 'clearly observable in nature' were protected – so perhaps the man-made nest boxes are not 'nature'? After an infringement procedure by the European Commission (Environment DG, 2004) the act was changed in 2004, but the doubts persist. The current interpretation is that nest boxes inhabited by the flying squirrel are protected by law. This has given rise to public opinion that placing nest boxes without the landowner's permission is not included in the traditional everyman's right that guarantees public access to the forest in Finland. However, putting nest boxes in the forest for birds is a long and respected vernacular tradition. Thus nest boxes continue to cause a dilemma for surveyors as well as urban planners and forestry professionals.

> "…if I had done surveys only around here [surveyor's home district], then I would probably miss half of the [west coast] flying squirrels – I would immediately think such forests are not worth a visit". (Surveyor 4)

4.3 Learning and being challenged

To further elaborate improvisation and the affective learning process of the surveyors, and the dynamics between the uncertainties of surveying in the field and the accurate information that is required, we analyse the role of indirect clues in knowing. We have put the three most important clues (faeces, habitat and nesting places) in a three-dimensional table (Table 2). The clues show different and puzzling combinations on every site, and thus there are only different (non-calculable) *probabilities* of flying squirrel presence. In Table 2 we have formed cases from A to H, where each is a combination of the three most important clues, all of them presented as binaries yes or no.

Cases A-H are not theoretical abstractions - we encountered every single one of these cases while with the surveyors. Some of the cases we encountered then and there, others were reported to us as anecdotes or examples. The cases form a rugged continuum between different degrees or probabilities of presence and absence of the flying squirrel. Not even the extreme cases of A (presence) and H (absence) are entirely certain, because in defining the presence of flying squirrels the surveyors can only rely on clues, and establishing their absence is even more difficult. The other six cases between the extremes are more common and require more interpretation.

The cases in Table 2, and especially those between the extremes are decidedly something that Bowker and Star call monsters and borderlands (1999, pages 304-305). The cases illustrate the difficulties and resistances in classifying the forest and drawing the boundaries of flying squirrel

breeding sites and resting places. Roth (2005) writes that often these monsters are dismissed or discarded or further evidence is gathered. Dismissal is not an option for the flying squirrel surveyors; the conservation standard and the planning procedure require that the whole area is classified into one category or the other.

In essence the in-between cases can be categorized into two: 1) finding faeces in "wrong" places (cases B, C and D) and 2) not finding faeces in "right" places (cases E, F and G). The surveyors deal with these in-between cases and anomalies respectively, by 1) *learning from the animal,* and by 2) *being challenged by the absence.* The dialectics between the two categories is at the core of survey work and knowledge generation, and is mediated by affect arising from the series of encounters between surveyors and clues.

Finding faeces in "wrong" places (cases B, C and D) can be indeed quite remarkable for the surveyors because most often unlikely-looking habitats are not even searched and the surveyors have found these clues only accidentally or received observations of droppings from someone else. The surveyor may remain very puzzled at the odd choices of the animal:

> And this is exactly what not even a biologist can understand when there is a perfectly good forest [nearby], [with] several trees with cavities. Why does it go in the middle of a clear-cut… These are the cases where maybe 90 per cent of squirrels act differently, […] these are really odd places […] (Surveyor 6)

Such anomalies are the very moments of *learning from the flying squirrels* – the animal has surprised the surveyor, who had been using her/his classifying vision for the forest but was proved wrong by the animal. The surveyor tries to understand the reasons of the animal's choices. Such

learning processes became visible when the surveyors offered their explanations for these surprises. Here surveyor 3 is explaining (in an office interview) possible reasons for some faeces he has encountered in odd places:

> […] I have been thinking that… sometimes you come across some, some random findings in very odd places […] in the springtime. It has occurred to me that they might be… male [faeces] when they are searching for females and.. and then if something has happened, for example a residential area has been built in between so that, that the.. traditional connections are cut off so they need to search, like, new routes, so they need to wander around a bit, to find a route. So one can imagine that in these cases the faeces can be found in very… strange places…

The surveyors also told us that they may modify their classification rules of thumb - those unlikely-looking habitats should more correctly be categorized as a suitable or at least potential habitat. These cases show that broken routines may lead to surveyors' self-reflection and improvement of the survey method. Anyway, unconscious conduct by affect forms the basis of the survey practice.

These moments of unpredictability are also the moments when the animal *agency* becomes visible – flying squirrels choose their own nests and habitats, and they may choose "wrong" for the human observer (see Philo & Wilbert, 2005, pages 10, 13; Lulka, 2004, Collard 2012, page 25). The squirrels live in their own *Umwelt* and perceive and use the affordances in their environment (see Warkentin, 2009, 23-28), and by doing so they participate in the conservation and planning networks (see Woods, 2005, page 202; Goedeke & Ricoon, 2008, pages 113, 127) frequently in unpredictable ways. Obviously, following Latour (2004, pages 75-77), the movements of flying squirrels are being tracked by surveyors, but the squirrels are not facts, objects or actors, instead

they are *associated* with the surveyors so that the flying squirrels can become *matters of concern.* At this moment, intuition, affective knowing and ethical consideration are in the play.

In contrast the cases when the surveyor does not find faeces in the "right" place are not so remarkable but quite commonplace. They are not surprises but rather explicit challenges to the practical and embodied skills of the surveyor: maybe there were faeces but these went unseen? Surveyors need to continuously adjust their practices in the forest, trying to estimate if they have "searched enough" yet or not, and they may wonder if their skills need further tuning. Philosophically this case is difficult, because in practice it is impossible to be certain of having looked everywhere, and theoretically, proving absence is impossible; absence of evidence is not evidence of absence.

Not finding the faeces in a "right" place does not necessarily mean that the surveyor has missed them, or classified the forest incorrectly. It may also be a case of "flickering presence" (Hinchliffe, 2008; Hinchliffe and Whatmore, 2006; Law and Mol, 2001) related to dynamics of the regional flying squirrel population, and the surveyors themselves were acutely aware of this issue. The flying squirrels change their nests from year to year and often from day to day within their home range (Hanski et al., 2000; Selonen and Hanski, 2003). They die, new ones are born and young squirrels disperse to colonize new sites, whereas some other suitable patches remain empty (Selonen and Hanski, 2004). According to the metapopulation theory, a certain, changing part of the patches in the matrix of suitable habitats should always be unoccupied (e.g. Hanski, 1998*)*. In fact, to be able to find signs of the flying squirrel at all, the surveyors need to be *synchronized* in a special way – not only skilfully spotting faecal pellets in optimal weather conditions in spring but also being lucky enough to be surveying in a time frame when signs of the flying squirrel happen to be present, not too distant in time and space from a living (and excreting) individual, a member of the changing

metapopulation. Hence, anomalies and flickering presence are among the most typical features characterizing the time-spaces of the relationship between flying squirrel and surveyor. As affect is trans-situational, inhabits the passage between contexts, and works through moments of discontinuity (Anderson, 2006), the dynamics enacted by anomalies and flickering presence creates affective relations between the surveyor and the flying squirrel.

5 Ethics and standards

Surveyors try to describe the complexities and uncertainties in their final report and the map attached. They may distinguish feeding areas from nesting areas, or the core area from the rest of the home range, or draw dots on the map indicating faeces or nesting trees found, or explain the uncertainties in the text of the survey report. As Bowker and Star explain, imposed standards produce workarounds (1999, page 159). However, in the end the planners need to deliver the answer to the question "is it there or isn't it there":

> […] but then anyway the report is read by the planner, and [s/he says] 'tell me, was it [there] or not, yes or no', [and I think], hasn't s/he read my text… 'I just looked at the map'…so it's always expected, the assumption is that one could always say, like, unambiguously the conclusion. (Surveyor 1)

Thus an unambiguous outcome is required of the surveyors. They accomplish this task by combining, adjusting and assessing hints, uncertainties, experience, theoretical knowledge, guidelines and experiential knowledge of the planning area. Waterton talks about "'connecting' knowledge" and the "cumulative crafting of partially embodied knowledges" (Waterton, 2003, pages 120-121). Roth (2005, pages 589-590) describes how categories always involve entities *and*

their backgrounds. These characterizations describe an epistemic field where affective knowing comes into its own, even though these writers do not use the concept of affect. Thus, in addition to the three kinds of clues described above, the surveyors may also use previous findings of signs of the animal, the feeling of how difficult it was to survey the site (to determine the risk of missing some clues), some other clues (such as the position, quantity and quality of faeces, not just their presence), forest structure, theoretical knowledge and experience of flying squirrel habitat use, moving habits and population dynamics and conservation science theories in order to delineate the breeding site and resting place.

Other than strictly ecological considerations are also weighed up: the administrative guidelines and legislation as to what parts of the habitat are covered by the conservation law and the development project context as to what is planned to be built and where, and how the squirrels could be accommodated. The surveyors may also rely on the expertise of other surveyors, environmental authorities and planners while drawing their conclusions.

Nowadays the surveyors often do much more than merely deliver their reports. They participate in the planning work, help the planners to understand the flying squirrel map and propose planning solutions that can save both the flying squirrels and the development project. Often the flying squirrel situation also needs yearly monitoring in the course of the planning or construction project. Surveyors do not always participate in planning, however. Sometimes the surveyor is merely asked to deliver her/his map and report, and never learns how it has been used. Reflecting the fear of losing familiar, even cherished places under urban sprawl, some surveyors told us they just cannot bear to follow what happens in the planning and construction process to the forests they have been surveying. For one surveyor, when we asked if there were some building plans for the spot where he had just found faeces, the draft plan appeared to be painful to see:

> I haven't yet, I haven't dared to look… […] Usually it's better not to look, you just lose heart, lose the work ethic and all, it's better to look at the end. (Surveyor 2)

The surveyors move in an affective and emotional terrain of hopes, surprises and losses. They hope to find signs of flying squirrels in a forest that deserves to be conserved and are glad when they do, and disappointed if they find none. Ambivalent feelings are commonplace. They wish to be able to contribute to conserving nature but fear that they may be helping to destroy it – they are paid by the very development project that may ultimately destroy the forest they have been working in. The emotions and ethical difficulties experienced by the surveyors seem to depend on their practical ties to and personal experiences of planning. The surveyors know that the classifications they make can have very concrete consequences (cf. Bowker and Star, 1999, page 326): certain observations and classifications connected with relevant legislation may have the power to delay, stop or postpone development plans and projects – and in their absence, this power is also absent.

The surveyors' emotional self-reflection on working practices and field classifications illustrates how their work is ethical - in the sense of "ethical sensibility or ethos of engagement that field scientists bring to their interactions in the field", as J. Lorimer (2008, page 398) describes the efforts and aspirations of corn crake scientists. The surveyors are aware of their crucial role in deciding the fate of the forest and the flying squirrels (possibly) living in it - in every decision they make in the field. They strive to be the authentic spokespersons of the flying squirrels, to find all the signs of the squirrels in the survey area and to make the right recommendations regarding their conservation.

In the case of flying squirrels, the conservation standard termed "breeding site / resting place" itself is tricky[4], and the surveyors explicitly told us they preferred other terms referring to the "area important for the flying squirrel". Some surveyors used the word "territory", although in accurate terms this is not considered correct since they are not territorial animals defending their territories (zoologist Ilpo K. Hanski, pers.comm.). Some used the term "suitable area", or the more scientific terms "home range" and "core area". We consider this preference to be an attunement to the habits of flying squirrels but also an ethical choice of being their spokespersons.

However, we assume that the main reason for the critical stance towards the concept of "breeding site / resting place" among the surveyors is due to the application of the conservation standard for flying squirrels in forestry. This forestry application differs from the one used in land use planning. The Ministry of Agriculture and Forestry and the Ministry of the Environment defined the conservation of the flying squirrel breeding sites and resting places in forestry in their guidelines at the height of the flying squirrel related conflicts in Finland in 2004 (Ministry of Forestry and Agriculture and Ministry of the Environment, 2004). The guidelines stipulate that the breeding site / resting place is a minimum of 10-15 m radius (about 700 m^2) from each nesting tree and includes at least one connecting tree corridor leading to a suitable forest patch. This is in stark contrast to the home range size reported in ecological studies (males move in areas as big as 60 ha between female home ranges, which range from 4 to 10 ha (see Hanski et al., 2000)) and also to practice of the surveyors we met.

[4] The conservation of the breeding sites and resting places is a conservation standard that is being applied through the Habitats Directive in Europe over a very variable range of animals (from wolves and loggerhead sea turtles to species of spiders and molluscs) listed in the annex of strictly protected species, and the concept works better for some species than for others. Necessarily the concept of breeding site / resting place needs to be described, interpreted and redefined for every animal species listed (Environment DG, 2007, page 14).

The forestry standard for breeding sites and nesting places became rigid and powerful mainly for three reasons (see more in Haila et al., 2007): (1) There has been a heavy political and legal pressure to specify the conservation by making forestry-tailored guidelines ranging from the European Commission infringement procedure to domestic interest conflict, (2) the forests are a very important natural resource in Finland, both economically and symbolically (e.g. Koskinen, 1999), (3) forestry in Finland has been extremely standard-driven for decades (Jokinen, 2006), and this paved way for the guidelines to become rapidly established. Within a short period of time, the nationally powerful forestry network stabilized the standard (Latour, 2005) and conservation practice close to the guideline's minimum requirements, whereas in land use planning the standard implementation has remained context-dependent and lacks size definition.

The surveyors interviewed, following their ethical sensibility, were acutely aware of the ecological incongruity of the forestry standard and the differences between the two standard applications. However they try their best, delineating the areas not too small for the animal to survive, but not too big either, to comply with the official guidelines, court judgments and the planning task in question. The surveyors stated they were on the flying squirrel's side, trying to give a truthful and accurate account of its needs case by case, and not making too many compromises.

6 Adapting the conservation standard under high uncertainties

Uncertainties in adapting the conservation standard have unfolded in many forms in our analysis. The flying squirrel surveyors do their work in a constant conflict between the accurate information demanded and the uncertainties and fragmentary clues found in the field. Beside this, the surveyors face another conflict, that between the rigid interpretation of the conservation standard and their knowledge of the habitat requirements of the animal. Consequently, the adaptation and application

of the conservation standard (or literally, the prevention of “deterioration or destruction of the breeding sites and resting places”) requires reflexive and case-specific work from the surveyors. Our findings show that affect is a central force between the surveyors and the flying squirrels and makes it easier to get the standard to work in highly uncertain circumstances. Affect operating through the encounters between bodies is essential for the surveyors coping with the two conflicts.

The argument we have developed in this paper is that (1) the emergence of affect in encounters between field surveyors and flying squirrels is at the core of survey practices, (2) affect makes improvisation and ethical consideration possible which is necessary when surveyors apply and adapt the conservation standard under high uncertainties, and (3) personal differences of field surveyors are not an obstacle to a reliable survey but on the contrary, they demonstrate that the surveyors have developed personal ways to co-operate with flying squirrels and thus participate in standard implementation and development where adjustment and improvisation is necessary and inevitable.

We found interaction between two affective moments in the surveyors’ work: a) attunement to reading the clues, bringing out capacities to understand the life of an elusive animal and b) attunement to the forest, which enables them to feel a sense of the forest. This interaction works through gradients of intensities. We call it the *circle of affective learning*, which enables the surveyors to manage with high epistemic uncertainties caused by the elusiveness of the animal (Table 2). In this circle different human-animal contexts open choices to surveyors by increasing their capacity, a capacity resulting from the affect arising in the encounters between surveyors and clues. These practices are embodied, including significant levels of sensitivity and flexibility, and resonate with research findings that emphasize embodied knowing in field studies and human-

nonhuman relationships (Bear and Eden, 2011; Eden and Bear, 2011; J. Lorimer, 2008; Roth and Bowen, 1999; 2001; Waterton, 2003).

The affective intensity (Thrift, 2004) and ethical energy emerging in the encounters between field surveyor and flying squirrels make improvisation and productive survey practices possible when the surveyors apply and adapt the conservation standard. In this respect, our study comes close to J. Lorimer's (2008) work on field inventories of corncrakes where he suggests that affectual interaction between surveyors and these animals may have a major role in knowledge building. What makes our case different is our focus on conservation standards under external pressure due to urban development and the crucial role of affect in making the strict standard usable. We are able to show systematically (Table 2) the main dimensions of uncertainties, the moving embodiments needed in knowledge gathering, and spaces where flexibility is particularly needed.

Concerning the design of conservation standards, a question arises about the right balance between control and flexibility. If too flexible, standards cannot serve their purposes, if too restrictive and over-precise, their local implementation becomes impossible. Strict standards are often defended in nature conservation and they are expected to produce standardized results and promote efficient policy implementation. If standards are strict, flexibility at the implementation stage becomes a critical factor, but there is no guarantee that this will lead to a positive policy solution. Bowker and Star (1999, page 157–158) made a similar finding relating to control and flexibility in governance: "by their very nature, classification systems need appropriate degrees of uncertainty and ambiguity to work; to destroy them would be unrealistic and counterproductive".

There will always be tension between affective relations and standards but they can also be mutually co-constructive – standards cannot be applied without affect and fieldwork. In our case the

pressuring standard has created the need to do fieldwork and become affected in the first place. Ambiguities arise during the implementation of a strict standard, but as our findings suggest, the surveyors are able to utilize the ambiguities through affective learning. Affective knowing and learning are more than rational, as they are based on capacities emerging at the moment of “not-yet” (Thrift, 2004). This is what we mean by learning from the animal and being challenged by its absence. These moments can be identified in the gradients of intensities that open choices to surveyors, in feeling states such as hope of finding the animal or ethical stances of conserving it, and in the intensification of affect.

As the surveyors advance in affective learning the strict standard serves as a resource for them in two different ways. First, not only is it embedded in their practice but it also becomes an epistemic resource - the need to define clear-cut breeding sites and resting places offers a task that compels the surveyors to really ponder how does the flying squirrel use its environment and how could it best be conserved. The standard also becomes a political resource for the surveyors when the results of the survey are presented for decision-making . Due to the strict standard, flying squirrels cannot be ignored in land use planning, but their conservation is always case-specific and needs skills and a careful practice. In this way the surveyors may reach flexibility that does not undermine the goal of conservation but can support it.

The interplay between the surveyors and flying squirrels forms a critical node in urban development and serves as an example of capacities for sustainability through affect, ethics and standard. More generally, productive interaction arising from human-non-human relations and generating ethical considerations is a significant resource for sustainability but poorly known. In the practices of flying squirrel surveyors, nature conservation not only reacts back upon its environments to generate new forms of technology (Williams and Edge, 1996), but also generates new

environments: it gives birth to new affective forms of knowing and opens new field for more sensitive governance.

Our conclusion is that the capabilities of biological field surveyors should be taken into account not only in local land use planning and standard implementation, but also in standard design to make conservation standards more usable in the implementation stage. More research is needed on field surveyors and their capabilities and affective capacities in different conservation cases.

Several writers in the science and technology studies have speculated that diversity in personality, experience, professional level and deeply held values are good for science and knowledge production, but it remains underexplored which types of diversity are good in which situations (Solomon, 2008, page 254). The same applies to field studies and nature conservation. As we found, professional development of the surveyors proceeds through the circle of affective learning, but this process varies due to different life histories of surveyors and personal variation in their human-animal relations. This leads to different paths of learning and personal diversity in survey practices, making the surveyors able to utilize their best capabilities in survey work. From the viewpoint of actor networks and collaborative governance in nature conservation, the flying squirrel surveyors bear a great potential as a group of diverse knowers, even though such diversity has not been acknowledged. Through affective knowing they efficiently explore highly uncertain environments by utilizing their personal assets, being "in the process of formation with the landscape" (Macpherson, 2010, page 8), and thus developing methods for managing uncertainties in knowledge generation. Such future-oriented knowing is needed in order to increase the resilience of environmental governance in uncertain environments.

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Table 1. Backgrounds of the interviewed surveyors.

Surveyor 1 has a Master's degree in biology and worked as a biologist in a consultancy firm. She has surveyed flying squirrels since 2000.
Surveyor 2 worked as a gardener, and has one year's training as a biological field surveyor and does freelance survey jobs for municipalities. He also has long experience in bird-watching, specializing in forest hawks and owls – a hobby where flying squirrels are regularly encountered.
Surveyor 3 has a master's degree in biology and has worked as a biologist in the land-use planning office of a big municipality since 1999.
Surveyor 4 has a master's degree in biology and worked as a biology teacher in a small municipality in Central Finland. He only does flying squirrel surveys as a hobby in his free time, but he has 20 years' experience in flying squirrel observation as a hobby with his father (with even longer experience).
Surveyor 5 has long experience as an amateur biologist and has 6 months' training as a biological field surveyor. He did freelance jobs as a flying squirrel surveyor.
Surveyor 6 was doing his master's thesis in biology on flying squirrel ecology and worked as a flying squirrel expert in the Regional Environment Centre.

Table 2.

Table illustrating the continuum of (non-calculable) *probabilities* of flying squirrel presence. The table shows the combinations of the three most important clues (faeces, suitability of the habitat and potential nesting places). In the last column, each case from A to H is a combination of these three clues, all of them presented as binaries yes or no.

Faeces found	Habitat suitable	Nests found	***Case A: Unambiguous presence***
		Nests not found	*Case B: Strong presence*
	Habitat not suitable	Nests found	*Case C: Anomalous presence*
		Nests not found	*Case D: Anomalous presence*
Faeces not found	Habitat suitable	Nests found	*Case E: Potential presence*
		Nests not found	*Case F: Potential presence*
	Habitat not suitable	Nests found	*Case G: Potential absence*
		Nests not found	***Case H: (Almost certain) absence***