

A Tidal Wave of Field Mice: Agriculture, Injurious Voles and the “Economic Relations” Among Species in the US Biological Surveys around 1900 *

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Summary

This article analyzes the moral and scientific construction of the vole as a dangerous, yet intriguing rodent. Using a case study of *An Economic Study of Field Mice (Genus Microtus)* by David E. Lantz as example, this contribution discusses the role that agriculture comes to play in knowing the behavior of animals in natural history, and in turning wildlife into a matter of national government in the USA around 1900. In this setting, the *Microtus* is given the shape of a “small [...] pest [...] that] inflicts enormous injury upon the crops of the country”. However, by granting field mice an important role in the agricultural development of the US Midwest, Lantz also qualifies the rodent as a capable agent deserving of scientific attention and political consideration. Thus, an animal otherwise perceived as repulsive and insignificant is transformed into an intricate being well worth dedicated study.

Keywords: Human-animal relations, natural history, agriculture, non-human agency, rodents

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In the summer of 1907, the Secretary of Agriculture is put on his guard. “Field mice”, Henry W. Henshaw warns him, “possess an economic importance quite out of proportion to their size”.¹ At the time, Henshaw is the head of the US Bureau of Biological Survey, the main government agency in charge of studying and managing the country’s wildlife. But what exactly is a “field mouse”? How has such a small and trivial creature come to interest the Biological Survey, and moreover the US Secretary of Agriculture?

In this analysis of the *Economic Study of Field Mice (Genus Microtus)* by David E. Lantz, I aim to observe how an animal today more commonly known as a vole is given a shape that renders it interesting and worthy of scientific attention at a given time and place.² River engineering, expanding industrial agriculture, the funding strategies of ornithologists, fox bellies and the rodent carcasses they contain, orchardists and huntsmen all have a vital part in enacting the vole as a small but harmful rodent that stands accused of causing vast damage to the USA’s agricultural growth.

Historical and sociological studies of animal ecology often are concerned with science’s relation with agriculture, fishing and trapping,³ the articulation between lab and field practices,⁴ local collaboration between such diverse actors as scientists, cowboys, fishermen and farmers,⁵ the importance of place for the production of knowledge,⁶ and the emergence of conservation and environmental policy.⁷ While these studies analyze the social and scientific construction of certain practices, communities and research problems for an-

1 Lantz 190, 2.

2 This article is part of an ongoing study at the University of Lausanne on the history of the prairie vole as an animal observed in natural history, zoology and contemporary neurobiology. Since the prairie vole was registered as a distinct species in natural history by Johann Andreas Wagner in 1842 (first named *Hypudaeus ochrogaster*, Wagner 1842), many different and contradicting behaviors have been ascribed to the ochrogaster: a proliferating pest to agriculture around the turn of the century (e.g. Lantz 1907), a companionable but polygynous traveler in the 1950s (e.g. Fitch 1957), a family caretaker with the males acting as “admirable midwives” in the 1960s (e.g. Gier and Cooksey 1967), a monogamous and dedicated parent in the 1970s (e.g. Thomas and Birney 1979), a diverse, “humanlike” social actor in contemporary studies (e.g. Young, Gobrogge, Liu and Wang 2011). Rather than seeing this development as a long, purifying journey from erroneous to more truthful accounts, I suggest to address these different versions of the vole by means of certain regimes of attention (Daston 2004) that seem to shape the biologists’ gaze upon the natural world at a given time and place. I try to show how these regimes render scientists attentive to different features of nature and of animals, thus calling very dissimilar beings and behaviors into existence.

3 McEvoy 1988; Brosco 1989; Dunlap 1990; Kohlstedt 2005; Brocking 2007; Kohler 2011; Hubbard 2014.

4 Kohler 2002.

5 Schneider 2000; Vetter 2008; Kohler 2006.

6 Burkhardt 1999; Shavit and Griesemer 2009; Kohler 2011; De Bont 2015; Lachmund and De Bont 2017.

7 Dunlap 1983; 1992; Worster 1977; Schneider 2000; Kingsland 2005; Alagona 2012; Rumore 2012.

imal observation, they rarely discuss the moral status of the species involved in these studies, the specific human-animal relationship the observed and the observer find themselves in, and the way in which this relation configures the research and shapes the ontology of the studied animals.⁸

This analysis of David E. Lantz's *Economic Study of Field Mice* offers a case study of how social appreciations, political transformations, scientific research and non-scientific allies relate. It suggests that the vole's history as a menace to agriculture matters to how the animal is studied and how its behavior is assessed, be it in outdoor field studies or laboratory research, where rodents are by far the most frequently used mammals for noxious and lethal experimentation. As such, this article is a contribution to a small but growing body of work in the social sciences observing how the moral status of animals, scientific research and political governance of animals and nature interrelate.⁹ In publications such as the *Economic Study*, naturalists like Lantz and Henshaw astutely engage with the farming concerns of the time to enlist and maintain the US Department of Agriculture as a patron of extensive wildlife studies. This alliance seems to inspire the natural historians to shape the animals they study into entities that can be governed by the Department of Agriculture for its own purposes. On the one hand, this implies ascribing an agricultural function to the various species and charging them with salient moral perceptions, notably by dividing all fauna into species "injurious" and "beneficial to man", "foe, vermin, scourge" or "friend of the farmer".¹⁰ On the other hand, the agricultural agenda of these studies also directs the scientific gaze to specific traits and habits through which the animal is understood, above all what it eats and how rapidly it breeds. Finally, this setting sparks new interest in the vole, qualifying it as an important actor that deserves careful scientific attention.

The backdrop for this agricultural funding strategy is the creation and sustention of a government office of natural history, the federal Bureau of Biological Survey. The BBS is the first national agency to extensively investigate and regulate US-American wildlife, with the means and aim to study the country's fauna on a large scale, and devise wildlife policies approved by

8 However, for a careful analysis of co-dependant changes in societal and scientific attitudes towards predators, such as the North American coyote, see Worster 1977, 256–290 and Dunlap 1983.

9 Despret 2004; Mougénot and Roussel 2006; Asdal 2008; Despret 2009; Mougénot and Morimont 2009; Despret 2010; Milton 2011; Ramsden 2011; Martin 2012; Nagy and Johnson 2013; Fountain 2014; Koch and Svendsen 2015; Benson 2016, Kirk 2016.

10 The division of all animals into "useful" (utiles) and "injurious" (nuisibles) species is one of the ordering principles used notably by Buffon in his "Histoire Naturelle" (see for example "Les Animaux Carnassiers", Tome VII). On social and political conflicts accompanying this divide see Worster 1977, 256–290, Dunlap 1983, Martin 2012 and Fountain 2014.

natural historians. Historian of science Robert E. Kohler calls it “an exemplar of organized, large-scale field science, a cornucopia of new knowledge and exact field methods, and the nursery of a generation of talented practitioners.”¹¹ After its creation in 1885, initially called the office of Economic Ornithology, the Bureau of Biological Survey publishes reports and bulletins on the activities, breeding and food habits of birds and mammals, with a special emphasis on their relations to agriculture. Other national offices pertaining to animals and wildlife are founded around that time, but the Bureau of Biological Survey is considered “the first public institution devoted to natural history survey on a continental scale”.¹² In any event, the creation of several agencies and the recruitment of natural historians and field agents into federal service mark an increased interest of the national government to describe and preside over its wildlife around the turn of the century.¹³

What makes agriculturally motivated field studies especially interesting and politically salient is that the authors grant the species they observe intricate and far-reaching *agency*, through which they are able to connect the animal to other beings and circumstances.¹⁴ In contrast to the taxonomical reports more commonly published by natural history societies, the agriculturally oriented field studies primarily define the species they study by the

11 Kohler 2006, 94.

12 Kohler 2006, 94. The Commission on Fish and Fisheries is founded in 1871, the Division of Entomology 1872, and the Bureau of Animal Industry in 1884. In a Brookings Institution series of monographs intended to study the US government’s administrative bodies, Jenks Cameron writes in 1929 that “this Bureau, though lacking an absolute monopoly in governmental natural history work by reason of the activities of such bureaus as those of Entomology, Plant Industry, Animal Industry, and Fisheries, the Forest and the National Park Services, and the Geological Survey, can claim to be that unit of the government most nearly possessing such a monopoly (Cameron 1929, 1).”

13 Many administrative reforms put in place during the Progressive Era (1890s–1920s) intend to expand state control over wildlife, the environment and natural resources. Designed to counteract the large-scale privatization of public lands and private governance of natural resources during the 19th century, the progressives “fundamentally reshaped the character of American environmental policy. They established environmental management as a major and explicit responsibility of the federal government, and they nailed to the door of government, figuratively speaking, the credo of utilitarian values, economic progress, efficient management of natural resources, and administration by technical experts in the public interest. [...They contended that] government should be an active force to achieve the public interest, a counterweight to the concentrated economic power of big business, not simply a ‘night watchman’ or laissez-faire protector of property.” (Andrews 1999, 152–153; 137). On the appropriation of nature and of natural resources by the US federal government during the Progressive Era, see also Hayes 1959; McEvoy 1988; Koppes 1988; Worster 1977.

14 Bruno Latour has argued that in scientific practice, many beings come into existence not by observing and confirming a fixed set of properties, but by studying ongoing processes and attributing agency. Using a paper of the Salk Institute on the Corticotropin releasing factor (CRF) as an example, Latour says that the neurotransmitter CRF’s “competences – that is, what they are – is defined long after that of their performances – that is, what they do” (Latour 2014: 12). See also Latour (2013).

traces of their *actions*. What is researched here is not so much a species, but, rather a series of actions and inter-actions that place the animal in a larger web of relations. The extensive study of the voles' behavior in the field is thus not only meant to define the rodent's characteristic habits, but also to provide insights into the "economical relations" that attach the vole to the actions of other animals, predators, gamekeepers, farmers, policy makers and crop yield.

By attributing decisive agricultural agency to an animal like the vole, Lantz and his colleagues invite the US Department of Agriculture to extend its authority, and to increase its control over beings considered to be located beyond centralized state regulation.¹⁵ What the authors seem to offer is the production of thorough knowledge relating to these new entities, as to their actions and interrelations, which could be utilized for the department's economical and political agenda. Their argument seems to be that, if national government were to take the agency of a species like the vole seriously and incorporate it into its calculations and manipulations, it would gain the power to *act* not only on the vole, but also on the other beings and surrounding circumstances to which the vole is connected.

But how does such an arrangement between policy makers and naturalists come about? And what are the conditions that inspire these different people to strike such a deal? In order to better characterize the constellation in which Lantz and the voles find themselves in the *Economic Study*, this first section explores the circumstances that lead to the creation as well as the maintenance of a government office of natural history. For it will require an international network of volunteer ornithologists, the surprising curiosity of an

15 Many progressive policies embody a proactive government stance towards both social and wild life, a strong state response to a world gone amiss and abandoned to its own devices: "a world in need of managing" (Worster 1977, 267). Arthur F. McEvoy has argued that much public action during the Progressive Era involves nationalizing what during the Gilded Age is considered to belong to market forces and the inexhaustible, unknowable domain of nature. "Nineteenth-century [US] lawmakers 'naturalized' – set beyond the realm of the knowable and the controllable – not only the ecology of natural resources but the market forces that disrupted that ecology. [...For example,] fishing in the long run could have no meaningful impact on the ocean environment, which in any case was beyond the grasp of human understanding and thus not a socially cognizable thing. [...] The law, in sum, had no business interfering with the 'natural', that is to say ineluctable, course of events." In contrast, the conservation policy of Theodore Roosevelt and his chief forester Gifford Pinchot claims nature and natural resources as public goods, to be ascertained and controlled by a strong state, guided by "impartial scientific expertise, economic efficiency and centralized planning in the public interest" (McEvoy 1988, 216–219). As this article will argue, the observations and wildlife recommendations Lantz makes are enmeshed in a struggle for centralized state control of flora and fauna, administrated by expert naturalists, and wrestled from the hands of private, regional actors such as ranchers, farmers, local lawmakers, hunters or livestock associations.

illustrious Austro-Hungarian prince, and a financing scheme that involves promises of higher crop yields before the federal government agrees to fund extensive wildlife studies. In a second step, this article analyzes how the vole's activity on farms and orchards is understood within a larger web of relations in David E. Lantz's *Economic Study of Field Mice*.

The contribution of birds to the wealth of nations: conspiring bird watchers, economic ornithology and the creation of a US government office of natural history

The US Bureau of Biological Survey, historians and chroniclers tell us, is the result of a plea made to the federal government by bird watchers.¹⁶ Regrouped under the American Ornithologists' Union (AOU) in 1883, the bird watchers launch a large survey of bird migration and send out 6000 circulars across Canada and the USA to ornithologists, bird-collectors, sportsmen, observers of nature, farmers, tradesmen, lighthouse-keepers, etc.¹⁷ The circulars inquire about the sighting of birds, of related meteorological conditions and other "correlative phenomena" (the sighting of other fauna such as frogs or reptiles, or flora such as the blossom of plants etc.).¹⁸ The AOU operates on a volunteer basis and disposes of no funds except the small contributions of its members. Any performed work is unpaid, and the circulars and other documents are printed free of charge by members who occupy influential positions otherwise, such as Spencer F. Baird, secretary of the Smithsonian Institution. In a request addressed to Congress in 1885, the AOU states that of the 6000 circulars already more than a thousand have been returned and that "[t]he material now in hand is of great value, and is so voluminous that the Committee cannot properly arrange, systematize, and publish it, without Government aid".¹⁹ In order to continue this already initiated, valuable but unpredictably challenging work in a systematic manner, the AOU suggests the creation of a governmental bureau responsible for the migration and distribution of the country's birds.²⁰

The bulk of returned circulars congesting the ornithologists' mailbox is, however, not as unforeseen as the AOU would have Congress believe. It is actually rather well in line with funding strategies bird watchers in other

16 Sterling 1989; Redington 1933; Cameron 1929; Kohler 2006.

17 American Ornithologists' Union 1885.

18 Merriam 1885, 118–120.

19 AOU 1885, 62.

20 AOU 1885, 67.

countries have also adopted. One year before, members of the AOU attend the first international ornithological congress in Vienna. One of the principal endeavors of the congress is to address the question of bird migration, a transnational phenomenon that draws increasing scientific attention during the second half of the 19th century in Europe.²¹ Many ornithologists consider border restrictions, the national boundaries of scientific research and the lacking presence of ornithologists in certain countries a great obstruction for the investigation of the birds' migration routes. The representatives of the various countries therefore decide upon the creation of a Permanent international ornithological committee for the migration of birds, an agency instructed to collect knowledge from all member nations and to facilitate scientific exchange and collaboration. It is placed under the personal protectorate of crown prince Rudolf of Austro-Hungary, the host of this first meeting.²² The members vow to exert pressure on their respective governments to establish bird observatories and to allocate funds for the study and publication of observations made. By doing so, the ornithologists hope to raise no lesser than "a network of ornithological observatories over the entire inhabited earth".²³

In its letter of request to the US Congress, the AOU argues that the decrees adopted in Vienna and the vivid international activity regarding bird migration oblige the USA to partake in the efforts, since "all civilized nations will probably contribute to its support within their own boundaries, and the work has already been carried on for several years in Germany, Austro-Hungary, and Great Britain".²⁴ The AOU addresses the scientific outcome of their work only very briefly, stating that its value is "too evident to require comment", but adds that the stationing of competent bird-collectors across the country would be of little expense, yet of great value for the collection of data.

By far the largest emphasis, however, is placed on the practical value of the Union's work, namely the prospect of higher agricultural output. The AOU elaborates very substantially on the concept of "economic ornithology", a domain that it says "proposes to study the interrelation of birds and agriculture, and to undertake a series of investigations of great practical value to the

21 Blasius and Hayek 1885, 2; Kohler 2006.

22 Blasius and Hayek of the ornithological committee give considerable credit to "His Royal and Imperial Highness, the most Serene Archduke Crown Prince Rudolf of Austro-Hungary, who follows all activities in the domain of science with advertence, [who] deigns to assume command at the enterprise's forefront, to adopt the protectorate over the first international congress and to inaugurate this very congress in person". The crown prince addresses, they say, "burning words to the assembly" and exhorts "To work!" to the delegates in view of the grand task that awaits them. Blasius and Hayek 1885, 1–4.

23 Blasius and Hayek 1885, 3–6.

24 AOU 1885, 66.

agricultural interests of the country”.²⁵ The AOU argues that if extensive reporting on the various birds’ food habits were to be conducted, there could “be no reasonable doubt that the farmers of the United States would profit to the extent of many thousands of dollars per annum by availing themselves of the results of these inquiries”.²⁶ Economic ornithology is meant to capably distinguish between, on the one hand, the birds “beneficial to man”, the ones that eat the enemies of the farm, namely noxious insects, rodents and weeds, and, on the other hand, “injurious” birds, the ones that have an appetite of their own for the plants the farmer grows. “Bird value investigations”, as Jenks Cameron calls them, have been conducted on local and regional levels in the USA since the mid 19th century, but the AOU’s proposal introduces a difference in scale.²⁷ By organizing the protection of beneficial birds (notably through hunting restrictions of hawks and owls) and the suppression of injurious ones (through import bans or hunting rewards for birds such as the English sparrow) *nationally*, a government bureau of ornithology could not only assist the local farmer, but, so the AOU promises, could increase the national output of agriculture and generate more prosperity and well-being for the entire country.

On 3 March 1885, Congress approves the request and installs an office of Economic Ornithology within the Department of Agriculture.²⁸ AOU secretary and treasurer C. Hart Merriam, who has been one of the main architects of the endeavor, enters his duties as chief of the new agency later that year. The office soon expands, includes economic mammalogy and finally receives the name Bureau of Biological Survey in 1907.²⁹ Historian Keir B. Sterling tells us Merriam hopes to maintain a dual objective for the Bureau: the official economic assignment received from Congress to study the relations between wildlife and agriculture, and a tacit and more far-reaching scientific agenda to study “which factors governed the distribution of life in North America. [...] Only when much of this foundation work had been done, he

25 AOU 1885, 63.

26 AOU 1885, 66.

27 Cameron 1929. For an extensive list on publications on birds in relation to agriculture from 1854 to 1901, see Weed and Dearborn 1903, 326–373.

28 Established only in 1882, the US Department of Agriculture is still expanding at the time of the AOU’s request, making it a good candidate for new public expenditure. However, it has a more clearly defined mission and constituency than other departments, its explicit mandate being to “acquire and [...] diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of the word.” In other words, because the USDA has the narrowly defined task to provide assistance to a constituency of farmers and agricultural businesses (Andrews 1999: 96–97), the Biological Survey must closely follow the USDA’s imperative to publicly account for the agricultural usefulness of its activities.

29 Cameron 1929, 256.

reasoned, would it be possible for him to get on with the official mission of his agency”.³⁰

However, US Congress takes the AOU’s original promise of economic utility for agriculture very literally, and holds the Bureau to its word. Merriam is summoned to congressional hearings on expenditures in the Department of Agriculture, and is “more than mildly heckled” by members of Congress, such as chairman Littlefield of the committee in charge who “made a rather aggressive attempt to pin down the Doctor as to just how the mapping of the various areas of the country inhabited by skunks could be of any practical benefit to agriculture”.³¹ The congressional report following the hearings states its difficulty in understanding the role “this odorous representative of the animal kingdom” plays in agriculture, and more generally criticizes how “it is extremely difficult for a layman unfamiliar with the subjects under investigation and the science relating thereto to form an intelligent and adequate opinion of the utility and value of the researches and investigations involved”.³² Growing congressional pressure from 1905 onwards compels Merriam to re-organize the Bureau’s activity in such a way that more immediate agricultural interests can be deducted from the reports published.³³ Disappointed by this arrangement and his assortment of functions, Merriam leaves the agency in 1910 after 25 years at its head and continues his research privately, with the help of a generous lifetime grant from the family of railroad mogul Edward H. Harriman.³⁴

The history of the first years of the Biological Survey, as told by Sterling and Cameron, unfolds as a tragic tale of economic versus scientific agendas, compromised (for third party interests) versus pure research (for the sake of universal knowledge). Actors like Merriam receive the role of a powerless scientist who, out of the blue, has his purse strings tightened “from above”: He spends his valuable time exploring truths of a value too evident to require comment, performing his work in a way best commended by objective reasoning rather than the capricious fashions of government spending. But then, the very same C. Hart Merriam who signed the request to Congress to create an office of Economic Ornithology seems more than aware of the latest trends

30 Sterling 1989, 181.

31 Cameron 1929, 37.

32 Congressional report, quoted in Cameron 1929, 37–38.

33 A large amount of the bulletins published by the Bureau of Biological Survey directly state the economical or agricultural character of the investigated animal as their main focus, such as *The hawks and owls of the United States in their relation to agriculture* (1893), *The economic value of the bobwhite* (1904), *The relation of birds to fruit growing in California* (1904), *Coyotes in their economic relations* (1905) and so forth. A complete list of all the Bureaus publications until 1928 can be found in Cameron (1929, 223–251).

34 Sterling 1989, 181.

in public funding. He addresses his request to the newly established Department of Agriculture, fully aware that it has recently funded the creation of the divisions of entomology and botany. Considering how the AOU rather adroitly achieves to relate bird migration to agricultural profits “of many thousand dollars per annum” in its argumentation, the ornithologists seem to knowingly engage in the construction of a demand, by linking their scientific work to a perceived social context.³⁵ Seen in this way, agriculture appears to function as a gateway for the natural historians to render the country’s fauna interesting.

The maxim of agricultural utility in the study of the US-American fauna seems to entail two consequences. First, early wildlife agencies such as the US Bureau of Biological Survey that establish environmental management as a government responsibility, seem to have a profoundly economical *modus operandi*.³⁶ The units, tools and concepts with which wildlife is described and regulated are guided by an obligation to articulate potential profit. The observed animals are organized into “stocks”, “economical relations” and “resources”. In the early years of the Biological Survey, many administrative tools for monitoring and intervening in the country’s animal population are put in place for the first time on a national level, and continue to be deployed for species protection and other conservation purposes until today.³⁷

35 As an example of “fabricated demand”, Latour quotes a letter Louis Pasteur addresses to the minister of public education of France in 1864. In his letter, Pasteur first emphasizes the value of wine as an agricultural treasure, and its recent increase in worth due to a treaty of commerce France has signed with England. He goes on to deplore the lack of knowledge relating to the chemical procedures rendering the production of this precious beverage possible, but immediately reassures the minister that he himself has been conducting experiments in fermentation for the last five years. For a mere 2500 Francs, Pasteur says he could buy indispensable chemical devices and devote his next vacations to researching alcoholic fermentation. Latour tells us that this kind of example is not meant to diminish Pasteur, but instead to show how he is a grand scientist because of it: “It is precisely because he knows to solicit, construct the demand of a minister who until then had little interest in scientific work that Pasteur will be able to build a laboratory” (Latour 2001, 21–22).

36 In 1940, the Biological Survey, for instance, is merged with the US Bureau of Fishery (significantly, from the Department of Commerce), relocated into the Department of the Interior and reorganized as the current day US Fish and Wildlife Services. On the development and relation between politics, economical thought and perceptions of maritime wildlife, see Hubbard 2014. Hubbard argues that the contention supported by Victorian biologist Thomas Henry Huxley that the deep-sea fisheries were inexhaustible were guided by convictions of economical modernization. Hubbard tells us that Huxley valorized evidence from shippers and marketers, who saw only growing markets, over fishers’ testimony that commercial fishing techniques like trawling were harming deep-sea maritime fauna. On the US Bureau of Fisheries, tensions between idealized ‘pure’ science and practical science purposed to yield applications for state patrons, see also Brosco 1989.

37 Andrews tells us that this constellation entails policy conflicts between “promoting agribusiness versus protecting wildlife habitat or promoting commodity production versus preservation and recreation on the public lands” (Andrews 1999: 96–97). On principles of utility and value assessment of nature in ecology and economy, see Price 2004. In an arti-

Secondly, if economic utility for the production of food acts as a channel through which the study of the nation's fauna can be justified, it also organizes the gaze through which the animal under study is known. As Jenks Cameron puts it, "economic law makes economic relations paramount".³⁸ In the Biological Surveys, a wide array of species is, for the first time, extensively studied and described by a government agency, but always with the pursuit of establishing their "value" in relation to agricultural production. In the case of the voles, as I will argue in the following sections, being classified as beneficial or injurious not only has a bearing on the animal's moral status in society, but also guides which properties and habits of the animal appear as relevant and noteworthy.

Rodent invasions and the precious "time and labor" of a badger: distinguishing friend from foe in the *Economic Study of Field Mice* of 1907

"Sometimes wild animals increase in numbers so suddenly that the change has been likened to a tidal wave, and ignorant people have regarded the invasion as of miraculous origin. The belief that crickets, locusts, frogs, and even mice sometimes fall from the clouds is still held in many countries. The careful observer, however, sees little mystery in the phenomena mentioned. He has studied the general habits of animal food, their powers of reproduction, their migrations, the checks on their increase due to natural enemies, disease, and varying climate – and consequently he attributes sudden changes in their numbers to known causes. In such changes he recognizes, especially, the influence of man, both direct and indirect, and his responsibility for interferences that greatly modify the operations of nature".³⁹

Maybe David E. Lantz does not blame the sudden appearance of a very large amount of rodents on odd weather conditions, nor on other divine tantrums. Nevertheless, he indulges in a mystifying and ominous depiction of

cle on Greenlandic Halibut fishing, Andreas Roepstorff describes how the responsible biologists justify fishing restrictions by referring to a limited "virtual stock" of Greenland Halibut, as "an attempt to define and characterize mathematically the behavior and number of fish" (Roepstorff 2003, 128), a fixed number, which, when certain subtractions occur, automatically triggers state restriction. The fishers of Disko Bay that Roepstorff has interviewed distrust the biologists' conception of the fish as objects in a finite stock, since the biologists "do not engage in the constant interaction necessary to understand 'the nature of the fish'" (Roepstorff 2003, 133). Thus, Roepstorff argues, the local fishers' resistance does not so much stem from a difference of interests, but of cosmologies. In the fishers' view, the fish may momentarily disappear for reasons not related to their scarcity, but to the fishermen's behavior. The Greenlandic word for overfishing, *aalisapilutoq*, denotes "someone who fishes more than he needs", relating not to the available fish in the stock, but to a moral concept.

38 Cameron 1929, 37. On the economical mindset and the "gospel of efficiency" that characterizes progressive environmental policies, see Hayes 1959 and Koppes 1988.

39 Lantz 1907, 5.

“rodent invasions”, presenting accounts of devastation from the “Old World” and the curse of the Philistines.⁴⁰ The introduction to Bulletin no. 31 of the Biological Survey, *An Economic Study of Field Mice*, reads itself like an ill-boding forecast. He recounts notable vole plagues in Europe, such as the scourge of Hungary in 1875-76, during which the rodents are supposed to have appeared suddenly in such large numbers “that the peasants ‘doubted whether they had sprung from the earth or fallen from the clouds.’ They devoured grain, roots, and growing vegetation – corn, potatoes, turnips, and lucern. In the fall they attacked vineyards and shrubbery, and when food was exhausted, began to eat each other”.⁴¹ The European field mice he describes seem to lack both the morals and manners apparently possessed by more balanced populations. During the “outbreaks”, the field mice migrate in “great hordes”, “run riot”, “kill [...] apple trees”, and “travel in vast armies, swimming lakes and streams, living on the products of the soil, and carrying calamity to farmers”.⁴²

Naturally, the author tells us, these bewildering and grave events cannot only be explained but – and herein Lantz places the interest and justification of his study – can be prevented: by thoroughly applying scientific method and by carefully heeding the advice and instructions of expert natural historians, rather than hearsay-practices or folk knowledge, which Lantz says “has led to ill-advised legislation against mammals and birds that are beneficial to the farmer”. For Lantz, the main reason North America has so far been spared the calamities the old continent experienced is precisely because the native fauna is more intact. While in Europe dense habitation and the hunting of rodent predators have left the field mice without “natural enemies”, the North-American fauna is productively assisting the farmer in his work by eating noxious rodents. However, a recent increase of smaller outbreaks of “rodent pests” in the USA, such as the “mouse year” of 1884, seems to bode ill for American agriculture as well.

“Prominent among the recognized causes for the great increase of rodent pests in recent years is the persistent destruction of the birds, mammals, and snakes that habitually prey upon them. [...] Gamekeepers have systematically killed foxes, weasels, stoats, hawks, and owls, on the plea that they destroy game, and even farmers have joined in the warfare against the so-called “vermin”. [...] Wise measures for game protection can not be too highly commended, but ignorance of the true relations of animals and birds of prey to game is widespread even among lawmakers and sportsmen’s clubs”.⁴³

40 “And the cities and fields in the midst of that region produced mice and there was great confusion and dearth in the city.” I Samuel, v. (Vulgate version); Lantz 1907, 7.

41 Lantz 1907, 7–8.

42 Lantz 1907, 6–8; plates IV, VII.

43 Lantz 1907, 38.

Lantz aims to determine the “economic status” of field mice, to describe the type and amount of damage they cause to the country’s economy, and to provide a series of measures that could reduce their population. In order to do so, Lantz and his associate field agents from the Biological Survey study rodent trails in farms, place traps, measure and describe dead voles, observe live ones in confinement, unearth tunnel systems, open nests, analyze stomach contents, and examine bite marks on trees in orchards and elsewhere.⁴⁴ The author insists that voles are not mice. But he prefers calling the rodent by one of its American vernacular names, “field mice”, rather than by the term “vole” natural historians more commonly apply. On the one hand, Lantz says he wants to avoid confusion with “mole” (genus *Scalopus*), on the other, his study seeks the attention of non-scientific audiences such as farmers or orchardists, and therefore prefers a term with a rural ring to it.⁴⁵

Instructions on how to protect trees, build traps, place strychnine and other poisons are given, but the most important of all defensive measures is attributed to the “work” performed by the “friends of the farmer”: the predators. Lantz argues that they have been wrongfully defined as “vermin”, because they may at times feed on farm produce. But since they prey on a more dangerous enemy, they in fact deserve protection for the valuable services they provide. The aim is of course not to avoid labeling animals as “so-called vermin”, but *scientifically* labeling them so. Lantz tells us that the most important way of establishing an animal’s useful or noxious character is by eliciting the “true relations of animals”.⁴⁶ It is by placing each species in a meshwork of far-reaching “economical relations” that the scientific observer can determine whether an animal is beneficial or injurious, the farmer’s ally or foe.

44 Lantz relates the results of his survey to the entire genus *Microtus*, but more specifically considers “three typical species”, selected by their wide distribution and the amount of damage they cause to the farmer’s crops: “the common meadow mouse” (*Microtus pennsylvanicus*), today called the meadow vole; “the prairie mouse” (*Microtus ochrogaster*), the current day prairie vole; and “the pine mouse” (*Microtus pinetorum scalopsoides*), at present known as the woodland vole. Lantz 1907, 15.

45 In Lantz’s eyes, there seems to be “no entirely appropriate vernacular name for the mice of the genus *Microtus*. The French call them ‘campagnols’, the Germans ‘wühlmause’. English-speaking people outside the United States call them ‘voles’. In the United States they are variously designated as ‘meadow mice’ or ‘field mice’ and locally as ‘bear mice’, ‘bull mice’, ‘buck-tailed mice’, ‘mole mice’, etc. ‘Vole’ is open to the objection that it applies equally well to three other genera and may easily be confused with ‘mole’” (Lantz 1907: 8). Inducing difference between two seemingly similar rodents here has not merely a taxonomical, but also an agricultural purpose. For while Lantz regards the insectivorous moles as beneficial to agriculture (they eat noxious insects), he perceives the voles as a menace due to their appetite for the plants of the farm: separating mole from vole is distinguishing friend from foe.

46 Lantz 1907, 38.

While the earlier, non-governmental natural history studies clearly divide the animal kingdom into useful and harmful relations “to man”, their frame of reference is often that of the individual farmer. In the extensive investigations of the Biological Survey such as Lantz’s *Economic Study*, these relations receive a statistical value, and are quantified and extrapolated to the national community.⁴⁷ Hence, the species under study is not just helpful or noxious to the farmer, but to agriculture and commerce as bases of prosperity and well-being of the nation. These evaluations are meant to pinpoint government policies and farming practices. However, Lantz’s examination also produces a moral value that seems to encrust itself into the very being of the animal, for what the animal is to be considered. Injurious, beneficial, pest, scourge, enemy, culprit, ally, friend, foe are emotionally engaging notions that Lantz deliberately uses to instill certain attitudes towards a species.

The predators are envisioned as valuable allies with strikingly economic virtues: “[the snake’s] beneficial **work**”; “skunks are **efficient** in the destruction of mice and rats”; “badgers, when not **employed** in unearthing larger rodents, devote much **time and labor** to digging out field mice”; “[the hawks] voracious appetites make them of **considerable economic importance**” (my emphasis).⁴⁸ For each species involved, a balance sheet is drawn to arithmetically consider whether the benefits they bring outweighs the casual losses they cause by stealing a goose or consuming on other riches of the farm. For most predators considered, their appetite for rodents “compensates in great measure for the injuries they inflict in other ways”.⁴⁹

The moral value attributed here to the predators and voles is not merely a question of image or representation, but possesses a productive function. By identifying the benefits and losses certain animals create, Lantz not only aims to advise state policy, but tries to engineer the social appreciations of these species, in the hope that it might generate specific dispositions and actions in society. Removing the label of vermin from predators, and endorsing it in voles is supposed to emotionally and morally affect farmers, politicians and hunters. It is meant to influence their attitudes and direct the actions that

47 In the *Rise of Statistical Thinking*, Theodore Porter writes that statistics were preceded by the term “political arithmetic”. The expression was coined by William Petty (1623–1687) who sought to bring “puzzling and perplex Matters [...] to Terms of Number, Weight and Measure” (Petty, in Porter 1986, 19). Putting ungraspable matters into numbers was not only intended for the neutral depiction of a current state of things, but also as a tool to devise policies in order to act upon them. Porter tells us that the use of numbers by political arithmeticians such as Petty or John Graunt (1620–1674) was underpinned by the conviction that “the wealth and strength of the state depended strongly on the number and character of its subjects” (Porter 1989, 19).

48 Lantz 1907, 53, 39, 40, 43.

49 Lantz 1907, 39.

they will adopt, namely to spare the predators from being hunted, and to thoroughly pursue voles.⁵⁰

Stomach contents and the “true relations of animals”

The most important indication to position a species inside the large web of “economic relations” is its stomach. It contains the traces of who or what else the animal is connected to by means of its food habits, and which spot it occupies in the arrangement that interrelates animals, plants and farming. In other words, the *Economic Study* primarily assesses animals, their behavior and beneficial or noxious character by what they eat. What is found inside the animal’s belly is meant to guide the collective measures to be adopted towards this species, in accordance with a larger cosmogony that relates the various species of the North American fauna to each other and to agriculture.

From Lantz’ view, accessing and interpreting these contents seems, however, to lie beyond the layman’s grasp. For while larger mammals swallow pieces that apparently are identified more easily, even by the naked human eye, Lantz tells us that “[o]wing to its finely chewed condition, exact determination of the food of rats and mice [...] is very difficult. This is especially true of the species of the genus *Microtus*, whose molars are well adapted for grinding”. Understanding what exactly the vole eats involves a very up-close look, and a thorough sniff, at the tiny contents extracted from the dead animal’s belly.

“A fair idea of the food can be gained, however, by a study of the animal’s environment, by the color of the stomach contents when bark has been eaten, the odor of wild onions when present, the presence of starch grains revealed by the microscope, or the character of the few perfect vegetable cells that remain”.⁵¹

50 Lantz’s call to protect predators will however be counteracted by the very agency he works for. Between 1906 and 1936, the BBS coordinates the “Warfare against Predatory and Noxious Animals” (Cameron 1929, 42; Worster 1977, 272–288): it undertakes large campaigns to systematically hunt, trap and poison animals that are considered deleterious by forestry and agriculture officials, notably predators such as wolves or coyotes. To a certain extent, the BBS hopes to best serve these industries with proactive control programs, and to prove its worth as an agency that can bring direct profit to the nation’s welfare, thus justifying its subsistence and continued expansion. The intention to exterminate predators creates a lasting controversy between naturalists siding with the Bureau of Biological Survey, who promote predator extermination as a service to forestry and agriculture on the one hand; and, on the other, naturalists convening around the American Society of Mammalogists, who feel progressively reluctant against entirely removing any species from the native fauna (Dunlap 1983; Worster 1977, 274–275).

51 Lantz 1907, 13.

The animal's stomach appears here as a concealed space of truth that can only be accessed and correctly interpreted through the privilege of scientific method, equipment and knowledge, namely: autopsy and careful retrieval of the stomach contents, investigation of the contents through the microscope, and, in case the food has been too well chewed, an expert nose.⁵²

Although Lantz gives little information on how he prepared the animals and extracted the stomach contents, he leaves little doubt that it is the hidden matter he locates and interprets inside the animal's belly that discloses the complex and invisible "economical relations" that govern the species' population in the natural world. Also, it is the reading of these contents that allow him to discredit the non-scientific accounts of the above-mentioned "ill-advised" gamekeepers, lawmakers, farmers and sportsmen. In the case of the red fox, for example, "[a]lthough reliable testimony to the destruction of domestic fowls [...] is not wanting, the habit is by no means common, as is shown by the contents of stomachs examined by the Biological Survey. In three cases remains of the Gambel partridge were found and in one other a small bird. On the other hand, harmful rodents, including field mice, were found in over 20 stomachs".⁵³ Although the layman's eye can testify to the fox stealing fowl by observing the stealth in the visible space of the farm's partridge stock, only stomach examination provides insight into the consumption of field mice, which occurs as an "operation of nature" in the invisible space outside the immediate domain of the farm.⁵⁴

The relations that Lantz deducts from the various animals' stomach contents not only appear as complicated and far-reaching, but as cunning and profoundly economical. Hence their importance for the Department of Agriculture. Much work performed by humans to limit vole populations, Lantz argues, is strenuous, expensive and often inefficient. Digging trenches, laying traps or other mechanical measures "involve much labor and are slow and often expensive", poisoning operations pose a considerable "danger to other animals and to human beings", and generally "corrective measures begun after

52 Several contributions from sociology and science studies have discussed how the use of animal bodies in modern science has epistemic forms and operations in common with religious sacrifice and divination (Lynch 1988; Rémy 2006; Birke, Arluke, Michael 2007; Panese 2007; Asdal 2008). The aim of such an approach is by no means to discredit scientific practice as occult and superstitious, but to understand the epistemic expectations underlying autopsy: the disclosure of an invisible system of relations that has left traces inside the animal's body. In the case of the voles, the careful preparation and interpretation of the stomach and intestines aim to reveal the larger, far-reaching "economical relations" that govern all species and their actions towards human crops.

53 Lantz 1907, 40. The gambel partridge is a pheasant variety.

54 Lantz 1907, 5.

a plague of the animals is in full progress have usually proved ineffectual”.⁵⁵ But if one were to consider the natural environment through the monocle of an economist, many seemingly unpleasant creatures take on the stature of an ally, and certain “operations of nature” appear as productive processes that seem to strive for similar goals as human agriculture: the balanced limitation of excessively multiplying populations.⁵⁶

Lantz’s contention that it is mankind who has caused certain imbalances in the subtle transactions of nature through imprudent hunting seems to suggest precisely this. Humans have the obligation to respect the logic behind these operations, but they also possess the faculty to modify and potentially utilize them for agricultural interests – provided they are thoroughly studied. One of the *Economic Study*’s tacit promises is that not only can natural history help repair past damage, but if the powerful and sophisticated “economical system” governing the population of species can be understood and appropriated, then natural conditions that favor the intensive cultivation of the Midwest can be knowingly engineered. The practical application of the *Bulletin* thus seems to less serve the reinstatement of an imagined “original order” of nature before human interference, rather than the finely tuned crafting of a balance that is favorable for agricultural growth.

55 Lantz 1907, 56, 63.

56 Vinciane Despret has mentioned how the narrative structure of natural historians at times evokes “a sort of ‘moral bourgeoisie’ of biology”, casting “nature” as wise and economical and considering the behavior of animals for “what they bring in” (Despret 2009, 12). Her comment pertains to the moral structure underlying accounts of Darwinian natural selection (expensive and “unprofitable” behavior being punished through extinction), but the role of Mother Nature as a grand economist who moves the beads of an abacus in order to govern her subjects certainly fits Lantz’s endeavors rather well. Similarly, in a study dedicated to entomologists during the Enlightenment, Lorraine Daston tells us that the naturalists frequently indulged in relating the parts of nature they studied to judgments of ‘utility’. These judgments, she writes, “as applied to the cocoon of a caterpillar or cell of a honeycomb, were strikingly similar to the judgments of utility applied to the fabrication of pins or the workmanship of locksmiths in Enlightenment descriptions of the arts and crafts [...]” (Daston 2004, 120). According to Daston, the entomologists did not only strive to understand the actions of their particular insect, but they were especially concerned with deciphering underlying principles of utility that were meant to govern insect and human industry alike. Indeed, “naturalists were not only interested in the final cause or purpose of the underside of a leaf or honeybee drones; they sought to understand what Bonnet called the ‘organic Economy’, in which the ‘arrangement and play of different parts of organized bodies’ explained operations like growth and generation. The choice of the word ‘economy’, used here in its eighteenth-century sense of an intricate system of interrelated, functional parts, was not accidental. The patterns of observing and describing in Enlightenment natural history and political economy resembled one another strongly” (Daston 2004, 120). In the *Economic Study of Field Mice*, Lantz seems to share a keen eye for the manifestations of utility that appear to transcend the natural world. Utility appears to suggest both an interior and exterior application here: as an organizing principle inside of nature that arranges and interrelates the vast amount of species of the North American fauna, as well as a sophisticated, operational resource that can be harnessed and wielded for human purposes outside of nature.

“A thousand mice in a meadow would require at least 12 tons of grass”: making voles matter to the national economy

While snakes, moles, skunks, owls or other rural habitants feed on insects, rodents or weed, Lantz tells us that voles indulge in the food enjoyed and grown by humans, such as wheat, oats, barley, rye, buckwheat, corn, vegetables, grass or the bark of fruit trees.⁵⁷ In this respect, Lantz does not object to what the observant farmer or earlier naturalists would also claim. However, he supplies these claims with numbers: numbers that permit estimations, projections and transformations of single accounts into a national scale, which, in turn, enable political measures and public expenditures. Lantz’s assessment of the voles seems to be organized into three discursive levels of collected evidence, measured impact and abstract projection.

#1 Calculated consumption of a single mouse, multiplied by 1000 to represent a population possibly living in one field, established from stomach contents retrieved during Lantz’s survey.

“The quantity of green vegetation eaten by a single adult field mouse in the course of a year has been calculated at from 24 to 36 pounds. When one considers in connection with this estimate the great numbers of these animals in our meadows, swamps, and forests, the total quantity of food consumed by them appears so enormous as apparently to exceed the productive capacity of the soil. A thousand mice in a meadow would require at least 12 tons of grass or other green vegetation to maintain them for a year. That a thousand of these small animals often inhabit a single meadow is not an extravagant estimate”.⁵⁸

#2 Locally occurred losses in a single plant nursery, estimated and attributed to the voles by a third party.

“In many sections of the United States and southern Canada nursery stock is injured by field mice. [...] Occasionally the havoc has been so complete that few marketable trees remained. It was estimated that during the winter of 1901–2, nurserymen in the vicinity of Rochester, N.Y., sustained losses amounting to \$100,000”.⁵⁹

#3 Potential national damage for the case of the prairie vole, projected by considering the locations in which the prairie vole has been sighted and the geographic distribution of national crop production.

“[The prairie vole] comes into contact with agriculture in the major portion of eight States lying in the humid section of the central Mississippi Valley. These eight States produce an-

57 Lantz 1907, 13, 23.

58 Lantz 1907, 13.

59 Lantz 1907, 24. According to measuringworth.com, the current day real price corresponds to 2, 52 Million US \$.

nually more than half the corn, oats, and winter wheat, and more than a third of the hay of the entire United States. [...] The possibility of serious crop damages from prairie voles is, therefore, especially great.⁶⁰

Lantz starts (#1) by providing a calculation on the basis of the materials the Biological Survey can account and vouch for, a multiplication that results in the potential consumption of vast amounts of crop on the level of a single field, which could concern a farm or a rural community. He corroborates this calculation (#2) by testimony from a third party from Upstate New York who presents an estimation of already occurred damage, on the level of a plant nursery. By extending the network of concerned actors from farmers to commercial orchardists and nurserymen, Lantz not only broadens the population affected by the seemingly unimportant *Microtinae*, but he also integrates actors who will provide financial figures. In order to show us their testimony, he reproduces answers received as part of a response to a circular, “On the Economical Relations of Mammals”, that is sent out to farmers, nurserymen and fruit growers by the Biological Survey. The farmers tend to express the damage by describing the vole’s methods as they have observed them, noting possible causes, surrounding circumstances and specific preferences, as well as by providing direct observation of their great number: like a man from Huron, Michigan, who writes that “the fields were swarming with them. I went out with my little boy and we killed 56 in an orchard in less than two hours. In going half a mile from the station the dog picked up 15. [...] They prefer apple to plum or peach bark”.⁶¹

The nurserymen and orchardists quoted, however, tend to provide financial estimations of the caused damage, such as a fruit grower from Twin Bluffs, Wisconsin, who indicates he had “perhaps 10,000 trees destroyed by mice and rabbits during the past five years, mostly by mice, in 1904 and 1905. Loss \$ 2000.” Or a nurseryman from Charles City, Iowa, who writes “we have a few thousand nursery trees destroyed by them each season”.⁶² The figures mentioned by the nurserymen and fruit growers speak the language of “dollars and dimes”, and immediately bestow the vole a measurable economical importance that can be booked as a loss to the national economy.

Finally, (#3) Lantz cannot provide figures of any damage for larger territories because “accurate statistics of losses are not available”.⁶³ Instead, he projects the smaller amounts he demonstrated into a hypothetical depiction of national crop loss potentially caused by voles. By making this and similar projections, Lantz makes the voles *matter*, in the sense that he renders them

60 Lantz 1907, 19

61 Lantz 1907, 30.

62 Lantz 1907, 36.

63 Lantz 1907, 23.

important to the national economy, yet also because he turns them into the stuff of large-scale calculations and national government. From this point onwards, federal policies can be suggested and justified with reference to estimated financial gains and losses.

The numbers that Lantz presents in the *Economic Study* are in this sense not merely an examination of natural history, but reshape the political character of the animals being estimated and calculated.⁶⁴ Lantz's study is entangled in a power struggle over which social actors have a say in the protection and hunting of the country's fauna, and on what knowledge their judgment is based. He challenges the way in which US-American wildlife is currently regulated, often leaving gamekeepers, farmers and, especially, hunting societies to shoot or import certain species without approval from natural historians. By mathematizing the debate, Lantz hopes to contribute to the settling of the property dispute over wildlife regulation in favor of expert naturalists such as himself who, incidentally, produce these numbers.

Thus, if there be an administration of the country's wildlife, then the Biological Surveys such as Lantz's *Economic Study* seem to subscribe to a plea for centralized, *national* government of the fauna, devised by natural historians rather than other, local and non-scientific social actors. Here, quantification and accounting operate as parts of a "technology of distance: geographical, intellectual, and social",⁶⁵ in which face-to-face interactions and trust are substituted by more formal and remote structures. Lantz's quantifications produce a specific form of knowledge, which does not have to rely on interpersonal trust, but prolongs the chains of interest from the single farm to the federal government.

“So rapidly do they multiply”: Excessive breeding, or knowing the vole in such a way as to govern its population

This study has so far addressed how Lantz and other naturalists label an animal as helpful or harmful according to its eating habits. However, what makes the voles especially pestilent in Lantz's eyes is not simply their ap-

64 Quantification and accounting, historian Theodore Porter tells us, are commonly deployed in order to provide science with a rationality that is "invulnerable to 'emotive considerations'" (397), as well as to enable a "technology of distance" (Porter 1999 [1992], 399). Porter says that the form of knowledge resulting from "quantitative protocol [...] is especially useful to coordinate the activities of diverse actors, and to lend credibility to forms of belief and action when personal trust is in short supply" (Porter 1999 [1992], 399). On the measurement and mathematization of wildlife, see also Kohler 2002, 97–118.

65 Porter 1999[1992], 399.

petite for human food, but also their impressive and somewhat mysterious “powers of reproduction”, their faculty to multiply in so large numbers that “whole districts have been reduced to destitution by this scourge”.

“European testimony proves conclusively that, like the lemmings, voles at times increase in numbers abnormally, but the causes are little understood. So rapidly do they multiply at such times that the results are astonishing. Females become pregnant within a few days after giving birth to a litter, and the number of young at a time is abnormal”.⁶⁶

Lantz considers “excessive multiplication” to be a rodent specialty, “but no rodents exhibit the tendency more forcibly than the *Microtinae*”.⁶⁷ He quotes several cases from Germany and France, for instance, observations made on a single large estate near Breslau, where “200,000 were caught within seven weeks and sold to a Breslau fertilizer factory at a pfennig (nearly one-fourth cent) per dozen. Some of the vole catchers caught 1,400 to 1,500 per day”.⁶⁸

Lantz writes that most frequently breeding takes place under the surface, in nests located in elaborate tunnel systems, yet with surface trails of great length that lead to surface nests for shelter. As he tells us, the breeding season includes most months of the year and that voles do not hibernate, which means that they multiply almost all year around. Even within the same subspecies however, “variation [...] is remarkable, and depends partly upon climate, but probably more on the scarcity or abundance of food.”⁶⁹ Limiting available food to decrease reproduction is not a mentionable option in the *Economic Study of Field Mice*, considering that the Biological Survey is meant to assist the cultivation of ever more territories. However, Lantz says that “elimination of the breeding grounds” is an important preventive measure that should be pursued, “by draining swamps and cleaning waste places that afford the animals harborage”.⁷⁰

Although some of the voles are nourished and observed in confinement, Lantz and his associates do not seek to achieve reproduction of voles in indoor colonies. The account of “breeding habits” Lantz provides stems from what he observes in and infers from conditions in the field (temperature, climate, opened tunnel systems), the female vole’s body (number of teats) and captured pregnant voles (number of young). Also, the information pertaining to breeding that is considered relevant in the *Economic Study* is what allows insight into crop loss, understood as a consequence of prolific reproduction. Thus, what seems to guide Lantz’s investigation and rendering of the

66 Lantz 1907, 11–12.

67 Lantz 1907, 6.

68 Lantz 1907, 12.

69 Lantz 1907, 11.

70 Lantz 1907, 63.

breeding habits of voles is his search for features that could illuminate the animal's reproduction as a rapid and prolific phenomenon. This disposition appears to privilege population estimations made from a number of young produced in a certain amount of time, and the circumstantial factors that may influence these populations.

The alliance with agriculture that the Bureau of Biological Survey has struck here seems to entail both a moral and a scientific configuration of what the vole is and how it behaves. On the one hand, farming and agricultural growth renders the reproduction of a seemingly unimportant rodent interesting, albeit by establishing the vole as a menace and endorsing the emotionally charged moral status of "vermin". On the other hand, the figure of the verminous vole has not only a bearing on the consideration for the animal in society. It also directs scientific attention towards specific properties and activities of the vole: namely, and almost exclusively, what it eats and how it breeds. Having, first, been identified as noxious through its food habits, the vole's reproduction is, secondly, constructed in such a way that it invites control and limitation of its population. The framing of its procreation as an *excessive* phenomenon does precisely that: it suggests a transgressed norm, an unhinged behavioral pattern that must be checked by well-advised intervention. "Excess" here both implies a deviation from an assumed biological standard, the absence of self-control and self-limitation, and an overflow that is felt in farms and orchards. But most of all, it prefigures surveillance and reduction of vole populations through government action as a systemic necessity.⁷¹

Further "outbreaks" and "plagues" of field mice in the 1920s will continue to supply a productive occasion to study the habits of microtine rodents under similar conditions, most notably regarding their reproduction and population growth, as well as their involvement in the propagation of diseases.⁷² Non-governmental mammological, physiological and ecological studies will soon turn to other problems such as fluctuating population cycles, develop-

71 This agricultural, interventionist approach contrasts the way research in population ecology will come to view sudden increases in voles. Ecologists of the 1930s and 40s consider periods of growth in microtine rodents to be a cyclical occurrence, followed by moments of decrease, whether humans actively control their population or not. On the contrary, Lantz regards unchecked vole multiplication as a potentially limitless phenomenon, in which a "single pair and their progeny in five seasons would amount to nearly 1,000,000 individuals" (Lantz 1907, 12). The ecological approach, wary of the controlled environment ideal that relies on constant corrective action, instead stresses the importance of self-regulatory processes in voles that take place without human intercession. For ecological studies of microtine population dynamics, see Hamilton 1937, Elton 1942, Jameson 1947. On the history of population cycles in ecology, see Kingsland 1986; Crowcroft 1991; Bocking 2007; Kirk 2014, 244–245. For the relationship between ecology and changing attitudes in wildlife policy see Worster 1977; Dunlap 1983; 1991; Kingsland 2008; Fountain 2014.

72 McCoy 1909; Bailey 1924; Wayson 1927; Selle 1928; Perry 1928; Munro 1929.

ment or the vole's role within the biota and vegetation changes of certain areas.⁷³ However, the figure of the vole as a proliferating, Old Testamental pestilence that brings calamity to farmers and rural inhabitants is a frequently used trope that grants a study of the animal immediate relevance. Before laboratory studies more frequently investigate the *Microtinae* in the 1960s for possible uses in experimental science, thus forging a new alliance that permits and at the same time configures the study of the animal, the vole largely remains what it is in David E. Lantz's *Economic Study of Field Mice*: a "small [...] pest [...] that] inflicts enormous injury upon the crops of the country".⁷⁴

Conclusion: Ecology, agriculture, and a slip of the tongue, or could voles be admirable?

In a compelling study on early political ecologist Stephen Forbes, environmental historian Daniel W. Schneider revisits Forbes' "The Lake as a Microcosm" from 1887. Schneider describes the local and political conditions that permit Forbes to imagine ecological systems.⁷⁵ An important aspect of Forbes' work at the Illinois Natural History Survey seems to be his desire to elaborate a "'working knowledge' of nature, an understanding of how to manipulate elements like 'its edible fishes, its injurious and beneficial insects, and its parasitic plants' for the benefit of humans". Schneider tells us "one of the reasons for Forbes's emphasis on the practical utility of ecology can be found in his struggles to fund the Natural History Survey".⁷⁶

The emphasis placed on "practical utility" in the hope of enlisting patrons and funding bodies strongly resembles the strategy pursued by Lantz, Henshaw, Merriam and the other naturalists at the Biological Survey. In order to interest the Illinois agricultural establishment, Forbes argues for the practical

73 Criddle 1926; Hatt 1928; Middleton 1930; Elton 1942; Jameson 1947.

74 Lantz 1907, 5. For social behavior ascribed to the prairie vole in field and laboratory studies, in which some male *Microtinae* behave like "admirable midwives" and dedicated fathers, see Stücklin (in preparation).

75 Schneider tells us that Forbes and the other scientists from the Illinois Natural History Survey heavily rely on the local fishermen to conduct their survey of the Illinois River and its adjoining lakes in the 1880s. Not only do the fishermen perform crucial manual labor, but they possess expertise in catching fish and offer important knowledge of the natural history of the fishes. Interestingly, as Forbes and other naturalists "absorbed the practices and knowledge of local resource users they came to adopt their political concerns as well" (Schneider 2000: 684). Forbes eventually becomes politically active in supporting the fishermen's interests, notably in struggles to prevent privatization of the floodplain.

76 Schneider 2000, 700–701.

value of his research by drawing “parallels between aquiculture and agriculture, referring to the Illinois River as a ‘flowing soil’ and to plankton as its ‘crop’, in an attempt to connect an agricultural perspective to river ecology”. Schneider shows how the importance of utility affects Forbes’s scientific program, configuring ecology as a tool for addressing practical problems. While performing his work on the Illinois floodplain, “Forbes was driven to search for knowledge about the working of nature as well as to provide practical advice for the exploitation of that nature”.⁷⁷

Historians of science have often examined the work performed by 19th and early 20th century naturalists in the light of the ensuing emergence of political ecology.⁷⁸ The natural historians depicted in these studies stand out as noble, bold and pioneering, as important contributors to a growing ecological conscience and early trailblazers for subsequent conservation policies and the protection of endangered species. The financial conditions, the allies from agriculture, the division of all species into “beneficial” or “injurious to man” are characterized as temporary necessities *on the side of* a more profound ecological awareness. The common reading of these events seems to be that eventually, once society gives these foreseeing scientists the unconditional support they deserve, the marks and traces of those temporary alliances will vanish into thin air. The biased study of nature for the benefit of agriculture can be cast aside, and the pure study of nature for its own sake can be pursued.⁷⁹

Considering the history and publications of the US Biological Survey, I would argue that this perspective dodges what strikes me as a key feature in the study of nature and wildlife, namely the way in which the particular circumstances, alliances and strategies shape the very fabric of the beings and entities assembled in the respective surveys. When Schneider tells us that Forbes sought to understand the “working of nature, as well as to provide practical advice” (my emphasis), I wonder whether replacing *as well as* through *by means of* would not help to provide an explanation that takes the naturalists’ declarations less at face value. Seen in this way, practical utility appears less as an addendum than as a working tool by which the natural world is explored. The main difference I would like to stress is that what seems to be at stake is not as much one chunk of knowledge (agricultural utility), added *on top* of another one (independent, deep ecological understanding), rather than

77 Schneider 2000, 702.

78 The publications considered for this argument are Sterling (1977), Sterling (1989), Brosco (1989), Dunlap (1983), Dunlap (1991), Schneider (2000).

79 For a critique of the paradigm of “pure science” (as opposed to applied science), see also Latour 2001, 11–44.

a *mode of knowing*: nature and ecology being imagined *by means* of agricultural concerns.⁸⁰

In the preceding sections I have tried to show how agriculture presents itself less as an obstacle than as a gateway by which seemingly unimportant parts of nature like skunks, voles or plankton are transformed into interesting beings, deserving scientific attention and requiring political administration. Here, the alliance with agriculture might, after all, permit a deep, thorough understanding of nature. However, by privileging a particular *mode of knowing*, it also obliges natural historians to assemble the animals they study into economical units in order to be agriculturally relevant. The outcome of such an assemblage is not just an issue of vocabulary (economical status, economical relations, etc.), but entails emotionally salient moral perceptions that generate certain dispositions and actions towards a species. In this respect, outdoor field studies with government funding differ from the observations made from the lifeless animal bodies in natural history museums: the animals are known, and thus their ontology shaped, in such a way as to yield implementable policies for the interests of the Department of Agriculture. Naturalists such as Lantz imagine relations among species and ascribe each one of them a moral value, *in view of* the particular priorities and potential uses this knowledge of the natural world might have to the enrolled allies.

I have argued so far that the *Economic Study of Field Mice* shapes the voles into a gluttonous and proliferating scourge, which causes the nation's economy important crop losses. And yet... the *Microtus* seems to keep a surprise or two in store for the more patient observers. For when Lantz describes the voles' housing arrangements, an apparent slip of the tongue turns the whole portrait upside down.

“In brush piles the writer has found [the nests] nearly a foot above the ground. Sometimes they are placed under flat stones or logs or under shocks of grain. The structures are so compact that the animals pass the coldest weather snugly housed in them under the snow. The nests are admirably located with respect to drainage, being so placed that they are not likely to be flooded during excessive rains”.⁸¹

80 The argument of “superposed” vs. “entangled” knowledge is borrowed from Annemarie Mol and John Law's paper on enacted bodies in the case of hypoglycaemia. Addressing debates on how the human body is viewed in medicine, Mol and Law argue that certain authors like Mark Sullivan demand that reductionist clinical examination be complemented by holistic knowledge: “They want medicine not only to look but also to listen; to grant patients their life as well as knowing them as if they were dead. It may seem hard to disagree with Sullivan's plea for a medicine that attends not only to its patients' organs but also to their self-awareness. But there is a problem with it: it leaves the modes of knowing involved untouched” (Mol and Law 2004, 44).

81 Lantz 1907, 11.

“Snugly”? “Admirably”? Did Lantz just imagine the pestilent scourge cozily tucked away under the snow? Did he just express esteem for their skillful engineering of drainage systems? Are these the same voles that devour everything in their wake before devouring each other?

In a study of Enlightenment entomologists, Lorraine Daston tells us that insects have often been considered as trivial and disgusting. The naturalists engaged in studying them have sought to redeem the insects as “worthy objects of scientific study and personal dedication”, looking for ways to “turn dross into gold, to create value out of the least promising materials” and to show that “‘there be gods even here’ [..., in the] underside of a leaf, the viscera of a worm, the tongue of a bee”.⁸² On the one hand, these naturalists tried to discern principles of ‘utility’ in order to defend their research as edifying or profitable.⁸³ Studying the noble and beautiful might require little justification, but observers of undesirable species seem to have to fend for their animal of study and explicitly demonstrate what makes their research valuable. In the case of the voles, I have tried to show how ‘agricultural utility’, among other things, seems to act as a tool that can render “worthy of attention” what is otherwise perceived as insignificant and repulsive.

On the other hand, these attempts of valorization were also “built into highly elaborated modes of attention”,⁸⁴ which obliged the naturalists to consider the minute with painstaking dedication. Daston tells us that this particularly meticulous mode of attention “also created pleasure, even when directed to objects initially deemed trivial or disgusting. Attention infused its objects with affect: the naturalists came to regard their bees and aphids and even insects extracted from horses’ dung with wonder and affection”.⁸⁵ Considering how Lantz and his associates pursue and examine narrow, long trail networks or hold minuscule, decomposing stomach contents to their nose in order to hint at the vole’s culinary preferences, can they have come to infuse their animal of study with affect? To even regard this swarming, crawling, belligerent pest with passionate devotion?

A thorough look at the *Economic Study of Field Mice* would only allow for a very modest, subtly disguised yes, if it helps to better seize the senses and motives involved in guiding the rodent’s actions. When eliciting the favorite food of meadow voles, Lantz tells us “I find [...] that certain succulent roots, particularly those of the wild white morning-glory (*Convolvulus*

82 Daston 2004, 100–101.

83 Daston 2004, 119.

84 Daston 2004, 101. For example, Réamur counted 84’000 bees leaving the hive in one day (Daston 2004, 114).

85 Daston 2004, 118.

septum), are preferred to everything else”. In order to understand the vole’s preference, Lantz does not try to analyze the nutritional properties of the morning-glory, but decides to take a bite himself: “This root tastes much like sweet potato and is abundant in swamps and waste places frequented by the mice. While feeding, [the voles] sit up on their hind legs and use the front paws to handle the roots”.⁸⁶

Whether Lantz sits on his hind legs while savoring the root the bulletin does not say. In every other respect, however, it is by putting himself *in its place* that the naturalist hopes to understand the vole’s appetite for the morning-glory. Through the experience of taste and the comparison with the human sensation of enjoying a sweet potato, Lantz constructs a commonality, hoping to infer from this shared sensation why the meadow voles stash such large quantities of the root in their underground caches. Instances of these human-vole inferences remain sparse in the *Economic Study*, and indeed appear more as slips of the tongue in the general endeavor to gather knowledge bent on controlling and reducing the voles’ presence in the American Midwest. Nevertheless, they indicate a possible being-otherness: one of the many shapes the vole could assume, once the surrounding circumstances, alliances and priorities change and other habits of the animal are considered *worthy of note*.

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86 Lantz 1907, 17. Morning-glory, also called bindweed, is otherwise regarded as an aggressive, noxious weed that climbs up and overwhelms cultivated plants.

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