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Wild experiments at the Oostvaardersplassen: rethinking environmentalism in the Anthropocene

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This paper draws together recent literatures on the geography of experiments and the potential of experimental modes of conducting science and politics. It examines their implications for environmentalism in the Anthropocene. We differentiate between two different conceptions of an experiment, contrasting the singular, modern scientific understanding of an experiment with recent appeals for deliberative public experiments. Developing the concept of wild experiments we identify three axes for critical enquiry. These relate to the status of the nonhuman world as found or made, the importance afforded order and surprise in the conduct of any experiment and the degree and means by which publics are included in decisionmaking. We then illustrate the potential of this framework through a case study investigation of nature conservation, critically examining efforts to rewild and de-domesticate a polder landscape and its nonhuman inhabitants at the Oostvaardersplassen in the Netherlands. This is a flagship example of the wider enthusiasm for rewilding in nature conservation. In conclusion we reflect on wider significance and potential of these wild experiments for rethinking environmentalism in the Anthropocene.

Key words experiment; nature conservation; Anthropocene; rewilding; Oostvaardersplassen; science-politics

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Introduction

The recent (and still contested) diagnosis of the Anthropocene[1] raises a series of important questions for the sociologies and geographies of science. How do we conceive of the subject of Natural Science in a world fundamentally altered by the consequences of scientific endeavour? Where and how is science to be done when laboratories have taken over the world and all are affected by the consequences? Who should environmentalists trust and what should they value if Nature has come to an end? These are big, unanswered questions that are currently subject to great debate. In this paper we want to make a modest contribution to these discussions by examining the utility of conceiving environmentalism as a series of *wild experiments* that cannot make recourse to Nature. These experiments involve open-ended, uncertain and political negotiations between people and wildlife. They occur in inhabited places and involve multiple forms of expertise, not all of which are human.

We develop the concept of a wild experiment by drawing together work concerned with the geography of environmental science experiments – the locations and trajectories through which experiments take place (e.g. Kohler 2002; Livingstone 2003) – and the character, potential and problems of 'experimental' modes of conducting environmental science and politics (e.g. Evans 2011; Hinchliffe *et al.* 2005; Latour and Weibel 2005). Although they share conceptual roots and political concerns, these two fields are currently rather disparate. We first offer a synthesis that identifies three related axes for the critical analysis of contemporary environmental controversies. We then examine the potential of this framework through a case study of ongoing efforts to 'rewild' and 'de-domesticate' a polder and its nonhuman inhabitants for the purposes of wildlife conservation at the Oostvaardersplassen in the Netherlands. In conclusion we reflect on the utility of thinking in terms of wild experiments for environmentalism in the Anthropocene.

Wild experiments

Open the *Oxford English Dictionary* and search for the noun 'experiment' and you encounter ambiguity. One definition describes an 'action or operation undertaken in order … to test a hypothesis, or establish or illustrate

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some known truth'. A second defines a 'tentative procedure; a method, system of things, or course of action, adopted in uncertainty' (OED 2013). What an experiment is clearly varies. Geographers, historians and sociologists of science have devoted significant time to establishing to where, when, what and whom these definitions refer. Their work maps a series of 'locatories' (Guggenheim 2012) or 'truth spots' (Gieryn 2006); places with specific epistemic properties from where or about which certain knowledge claims can be made. A common account links the first definition to the singular understanding of an Experiment[2] associated with positivist approaches to natural science. As we explain and illustrate below, this figure of an Experiment is a theoretical caricature; a powerful rhetorical device, but one alien to many of the scientists whose work it purports to describe. Here it offers a useful heuristic for mapping and specifying the shifting ideas and forms of experiment suggested by the second definition.

Gieryn argues that the ideal location for an Experiment is the laboratory, whose

> walls enable scientists to gain exquisite control over the objects of their analysis. Wild nature gets repositioned in a technical and cultural environment that gives all power to the investigators. (2006, 5)

Laboratory research is thus 'inconsequential' (Guggenheim 2012) to the world it investigates, as there is a clear spatial division between a controlled environment and the knowledge object it purports to model. Laboratory walls also control who can contribute to and contest the production of natural knowledge. The standardisation of laboratory spaces allows scientists at diverse locations to assume that the conditions 'here' are equivalent to those 'everywhere', and thus experimental results can be generalised (Gieryn 2006). In Kohler's (2002) terms labs become 'placeless places' purified of the contaminants of the wild. Unfalsified (but falsifiable) hypotheses that have been tested in the lab can be taken as objective truths about a singular, stable and transcendent Nature that should inform, but not be contested by politics (Latour 2004).

Researchers have critically examined efforts to 'laboratise' other locatories (e.g. Bockman and Eyal 2002; Greenhough 2006) and documented the contrasting epistemic properties of places defined in inferior relation to the laboratory. The most relevant of these alternative locatories for the concerns of this paper is 'the field'. Gieryn argues that in contrast to the lab, the field is 'found', not 'made'. It carries with it 'an idea of unadulterated reality just now come upon' (2006, 6). For Kohler (2002) 'experiments in nature' involving controlled manipulations are rare due to the unpredictable and multivariate character of the phenomena under investigation. Environmental field sciences involve 'practices of place', the careful selection of suitable locations to observe and measure 'nature's experiments'. The understanding of an environmental science experiment recounted here is closer to the second definition offered above – of a tentative procedure adopted in uncertainty. Gieryn argues that in the field 'a lack of control becomes its own virtue. Scientists en plein air are more likely to be open to surprises that might interrupt research expectations in promising ways' (2006, 6). Field sites are much more public and visible than laboratories and interventions will have real-world consequences. Gaining authority within them involves very different social practices including negotiating with and sometimes learning from heterogeneous epistemic communities like farmers, hunters and other amateur naturalists.

Table I summarises the contrasting epistemic properties of laboratories and field sites and sciences that have been identified in this work. It offers a useful heuristic; but it should not be read as a list of binary oppositions for at least three reasons. First, there are multiple forms of applied science that 'shuttle' between such truth spots (Gieryn 2006) gaining authority from each. Second, the philosopher-biologist Hans-Jorg Rheinberger (1997) has documented how the 'experimental systems' of laboratories are poorly described by the positivist definition of an Experiment. Often science is practised without theory or even testable hypotheses, is infused with local values and must wrestle with unpredictable and surprising materials. A multitude of laboratory ethnographies have demonstrated that labs are much like field sites comprising experiments that are tentative, local and uncertain. More fundamentally, critics argue that the ubiquity of modern science – in terms of both the knowledge it has created and the consequences it has unleashed – has erased the boundary between the lab and field. As such, the Anthropocene is characterised by real-world experiments (Krohn and Weyer 1994), in which all of us should be (but are often not) involved in deliberating as to their conduct and consequences (Latour 2011).

This recognition of science as a set of social, uncertain and consequential practices taking place in specific locales is central to a wider range of work in STS. It has provoked a series of fundamental reap-

Table I Comparative partial summary of the properties of ideal laboratory and field sites and sciences

Laboratory science	*Field science*
Made/artificial	Found/natural
Ordered/domesticated	Disordered/wild
Inconsequential	Consequential
Anywhere/placeless places	Here/practices of place
Secluded/private	Visible/public

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praisals of the 'Modern Constitution' (Latour 2004) that elevates laboratory scientists and the 'political epistemology' (Latour 2004) of the modern model of the Experiment as the single route to Nature, removed from politics. Strands of this work trace and compare the influence of specific 'civic epistemologies' on the co-production of science and society in different (usually national) contexts (e.g. Jasanoff 2005). More normative research critically interrogates, proposes and tests novel techniques for real-world experiments that might better democratise science and technology. This is a burgeoning field, involving a wide array of forms of expertise, knowledge controversies, models of politics and spaces and connections. Here, we focus on one influential strand of thinking about expert-led forms of public experimentation that is especially well suited for the concerns of this paper.

In a recent book, Callon *et al.* (2009) review the proliferation of 'hybrid fora' in which various forms of expertise come together to deliberate knowledge controversies relating largely to the health and environmental sciences. They differentiate 'research in the wild' from 'secluded research'. The latter, they argue, can take place in lab and field and still has an important role, but can (and should) be linked to its publics through engaging in the former. In promoting this political conjunction they critically evaluate existing techniques for public engagement according to their ability to promote 'dialogic democracy' and to 'facilitate and organize an intense, open, high-quality public debate' (2009, 178) among emergent collectives of experts. This ability is what makes research 'wild'. The locatory properties of the wild are unspecified but it is clear that the wild is not the anti-modern wilderness. In a similar vein, Matthias Gross (2009) encourages a more humble conception of the ideal laboratory Experiment as a useful, but rare type of experiment, whose 'real' and 'true' form is to be found in public experiments in the real world, involving both knowledge production and application.

The actors in Callon *et al.*'s experiments are decidedly human. Further work in geography and STS develops a 'more-than-human' (Whatmore 2006) and spatially attuned approach to environmental research in the wild. For example, Hinchliffe, Whatmore and their co-researchers draw on Stengers and Latour to present 'cosmopolitical experiments' in urban ecology and flood-risk mapping (Hinchliffe *et al.* 2005; Lane *et al.* 2011; Whatmore and Landstrom 2011). These involve deliberations between multiple forms of agency, expertise and subjectivity – some of which are human, some of which require tuning into the diverse becomings of nonhuman forms and processes. Similarly, Gross describes practices of ecological restoration in situations defined by 'ignorance' as acts of 'multi-species communication' (2010a, 272). These experiments take place in post-industrial 'urban wilds' (Hinchliffe *et al.* 2005) in North America and Europe; ubiquitous locations that are neither found nor made.

These authors draw on Rheinberger's (1997) influential epistemology of an experiment as 'a trial or a venture into the unknown' (Gross 2010a, 4) that is designed to generate surprises. Rheinberger presents science as speculative and argues that a well-designed 'experimental system (1997, 24) will be capable of generating and detecting difference, not confirming what is known. Extending this approach to the field, Gross (2010b, 63) promotes the 'public proceduralization of contingency within real-world experiments, seeking to nurture and learn from emergent events. This epistemological commitment to immanence resonates with Hinchliffe's (2008, 88) appeal for a 'careful political ecology' a mode of field science that remains open to the emergence or 'likely presence' of nonhuman 'wild things' (Hinchliffe *et al.* 2005, 643). Here Hinchliffe voices an increasingly common critique that those charged with conserving biodiversity and ensuring biosecurity struggle to theorise, anticipate and live with surprising ecological events (Marris 2011). This inability results in a tendency towards the imposition of forms of transcendent order that often have poor ecological (and sometimes social) consequences.

Table II summarises the differences between the two understandings of an environmental science experiment with which we opened this section. The table compares the singular modern Experiment with an alternative model of wild experiments.

There is a growing debate in geography and elsewhere about the politics of this epistemological shift and the implications of forms of 'government by experiment', which critics have identified in a number of contemporary policy domains. For cautious advocates like Hinchliffe (and his co-authors) (e.g. 2008 2012), writing about both wildlife conservation and biosecurity, a shift towards immanence and experimentation offers a more dynamic and democratic model of environmental governance, decentring Science and offering a political ecology less tied to 'rendering the present eternal'. Bulkeley and Castan Broto (2013) are more circumspect in a recent review of an experimental turn in urban adaptations to climate change. They argue that 'rather than operating as open-ended, learning processes, we find that experiments are often vested with particular interests and strategic purpose' (2012, 13).

Here they echo Evans' warning that

> it may be exactly the emphasis on flux (and the rejection of stable Nature), which appeals to geographers as the basis for a more progressive environmental politics, that produces this political foreclosure. (2011, 232)

Without a Nature to protect and a Science to unequivocally define its properties and mark its

Table II Key properties of two models of an environmental science experiment

	Experiment	*Wild experiments*
Ontology	Transcendent order of Nature and Society	Immanent and indeterminate world of humans and nonhumans
Epistemology	Hypothetico-deductive method	Designed to generate surprises
Politics	Delegative: science creates facts, politics decides what matters	Dialogical: emergent collectives for generating and deliberating knowledge
Location	Laboratory (and occasionally the field)	The 'wild'

boundaries, real-world experiments risk becoming aligned with the interests of the powerful. For Evans any shift to immanence must remain aware of the broader (neo-liberal) regulatory context, which bounds any experiment and frames the ends to which its outcomes might be put. To an extent these differences are empirical and relate to the specific experiments under consideration, but this nascent debate raises important questions about the conceptual and political utility of wild experiments, to which we will return in conclusion.

The concept of a wild experiment develops an existing research agenda concerned with specifying and critically engaging with the real-world experiments of the Anthropocene. In the sections that follow we wish to illustrate and test its utility for addressing the questions that opened this paper by identifying three specific axes for critical enquiry. The first, entitled found–made, thinks through and beyond the ontological commitment to Nature that configures the contrasting epistemic properties of the laboratory and the field. The second, entitled order–surprise, examines the epistemological and political challenges associated with anticipating surprises and generating emergent knowledge. The third axis is entitled secluded–wild and develops Callon *et al.*'s framework for engaging publics in political decisionmaking with environmental scientists. These axes do not sketch binaries, but list variables that are differentially conjoined in any real-world experiment. Before illustrating their significance we will first introduce the case study.

Rewilding

There is a growing interest within nature conservation in the theory and practice of 'rewilding'. While there are significant differences between rewilding imaginaries and projects within (and between) European nations and North America (see Fraser 2009), they share a desire to shift the reference baseline for conservation towards the ecological conditions that existed at the end of the Pleistocene (*c.*11 700 years BP). For advocates in Europe, like the non-governmental organisation Wild Europe (whose field programme is entitled Rewilding Europe),[3] the aim is to create analogues of what emerged after the retreat of the glaciers and before agriculture, forestry and animal domestication. This implies a dramatic reorientation of conservation away from rare species inhabiting fragments of premodern agricultural landscapes, towards ecological processes – especially predation, grazing, succession, dispersion and decomposition (Rewilding Europe 2012a). Current projects are largely targeted at abandoned or marginal land in peripheral upland and/or East European locations. Here rewilding is promoted as a panacea, delivering a range of 'ecosystem services' (biodiversity, carbon sequestration and flood prevention) on the cheap – by cutting subsidies, promoting non-consumptive land uses (i.e. ecotourism) and leveraging new forms of conservation finance and biological property (e.g. offsets). Rewilding is presented as a dynamic mode of conservation better able to adapt to the uncertain ecologies of a changing climate (Navarro and Pereira 2012).

There is an important regional geopolitics to this initiative (see Schwartz 2006) and the tentacles of a nascent neoliberal environmentalism are evident in the invocations of ecosystem services and biological property. These are critical developments that frame the experiments that we report below. However, the case study for this paper – which is arguably the most high-profile and frequently cited exemplar of rewilding in Europe – confounds some of these familiar conservation geographies.[4] Here we focus on the Oostvaardersplassen (OVP), a publically owned polder just north of Amsterdam in the Netherlands (see Figure 1). Reclaimed from the sea in 1968, this land was initially designated for industrial development. This did not occur and the site was abandoned and colonised by greylag geese, whose grazing behaviour prevented forest succession and created ideal habitat for a range of rare and migratory bird species.

In the 1970s the public authority for the reclaimed land began actively managing the area for nature conservation site and it was formally made a Staatsnatuurmonument (State Natural Monument) in 1986. A few years earlier, the site management team, including the ecologist and bureaucrat Frans Vera, had introduced herds of horses and cattle to diversify the 'naturalistic grazing' performed by the geese. In 1992

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Figure 1 Map showing the location of the Oostvaardersplassen

these were supplemented by red deer (for more on the history of OVP see Keulartz 2009). These animals gradually 'de-domesticated', developing behaviours and creating ecologies that are claimed to be analogous with Europe at the end of the Pleistocene (see Vera *et al.* 2007). In 1996, OVP management was transferred to Staatsbosbeheer (the State Forestry Service).

Inspired by his experiences at OVP and his PhD research, Vera published a book (Vera 2000) that outlined a new paradigm for European paleoecology and (consequently) nature conservation. He challenges the orthodox assumption that the climax equilibrium vegetation for Western Europe at the end of the Pleistocene was the closed-canopy 'high-forest' and proposes an alternative, non-linear model of shifting forest–pasture landscapes, kept partially open by the grazing of large herbivores. The accidental ecology of OVP offered a unique opportunity to 'experiment with large ungulates living in the wild' (Vera 2000, xv) to test his alternative ecological hypothesis and to demonstrate their implications for wildlife management. Vera and his collaborators' thinking and advocacy on behalf of the OVP experiment helped drive a paradigm shift in Dutch conservation towards 'nature development'; engineering 'new nature' with large herbivores in a networked 'ecological main structure' (*Ecologische Hoofdstructuur*) (see Baerselman and Vera 1995; Belt 2004). OVP and Vera's alternative hypothesis have subsequently been invoked as a key source of legitimacy for the Rewilding Europe programme.

As we will explain in more detail below, Vera's theory, the management of OVP and the wider policy shifts they are being used to justify have proved controversial in the Netherlands and across Europe. In short, traditional conservationists fear the loss of habitats for rare species, animal welfarists are concerned with the ethics of de-domestication, farmers and other rural citizens are anxious at the demise of cultural landscapes, while scientists contest the veracity of Vera's paleoecology and its utility as an ecological baseline. The management of the OVP has been subject to two enquiries by international commissions assembled by the Dutch government *(International Commission for the Management of the Oostvardersplassen (ICMO)*) (see ICMO 2006; ICMO2 2010). Much of this debate centres on the framing of OVP as an experiment. As we hope to show in the analysis that follows, the import, problems and potential utility of the OVP experiment can be disentangled by making reference to the three axes for enquiry that were introduced above.

Found–made

The first theme develops and tries to think beyond the distinction between the laboratory as a 'made' space for controlled experiments whose findings are universal, and field sites as specific, authentic places 'found' by scientists. In conducting and describing the rewilding experiments at OVP, Vera and his colleagues shuttle between and have more recently sought to go beyond these two positions. On the one hand, they present OVP as an ideal laboratory to test a scientific hypothesis. The land was literally made; created from the sea as part of the largest artificial island in the world. Bereft of any material cultural history the terrain and hydrology can be sculpted with dikes, pumps and diggers. As the site is fenced and entrenched flora, fauna and human access can be controlled.[5] Within these bounds prehistory can be simulated, as on *Isla Nublar*, the fictional island in Jurassic Park. However, the scientific legitimacy of OVP as a site to test Vera's paleoecological hypothesis (and from which to scale up

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its outcomes) requires that it be accepted as analogous to wild 'found' sites (past and present). Here it is necessary to downplay human intervention, to stress the abandonment of the land, the 'self-willed' or 'spontaneous' nature of its ecology and its subsequent discovery by conservationists. Histories of the site ascribe great agency to the geese (and subsequent herbivores) as architects of ecological change (see Vera 2000).[6]

Critics of the OVP experiment have tended to focus on revealing purported paradoxes that undermine its found or made status. For example, commentators sympathetic to the farming and hunting lobby dwell on fences and flood control, arguing that the artificiality of OVP undermines its authenticity (Kasteren 2010). Their concerns are echoed by sceptical social scientists versed in the techniques of deconstruction, who mock claims to prehistorical authenticity (see Onneweer 2009). In contrast, Dutch and UK ecologists take issue (in print and in interview) with the presentation of OVP as a lab. They challenge the degree of control that has been exerted and the extent to which its findings can be generalised. They note the arrival of pollen and invertebrates from outside the reserve, flag the unusually high fertility of the soil and highlight the unique circumstances that allowed the site to evolve (see for example Birks 2005; Hodder *et al.* 2005). OVP is presented as a distinct place, not a generic laboratory.

Partly in response to these criticisms (and with a certain degree of reluctance on the part of Vera) advocates have sought to move beyond the lab–field shuttle. Here they pitch OVP and rewilding in general as a model for conservation in the Anthropocene, where found–made distinctions hold less sway. For example, Vera no longer presents his paleoecological baseline as an authentic return but as a dynamic 'reference' (2000, 24) for future management. In her recent appeal for a postnatural mode of wildlife conservation, Emma Marris (2011) heralds the OVP experiment as exemplary for conservation on a 'ragamuffin earth'. For Wild Europe (2010), this necessitates a discursive shift from the 'unspoiled' to the 'untamed'. Here the emphasis is on processes, which they argue serves

> to highlight rewilding as a concept that does not aim at the fixed conservation of particular species, habitats or a priori lost landscapes, but rather opens for (sic) the continuous and spontaneous creation of habitats and spaces for species. (Rewilding Europe 2012b, np)

This enthusiasm for spontaneity raises a series of epistemological and political points that we address under the second and third axes.

Before turning to these, we can address a related ontological controversy that flared over the legitimacy of experimenting with cattle and horses at OVP. As the aurochs and tarpan are extinct, Vera selected 'backbred' animals with hardy natures and wild aesthetics as his surrogate bovine and equine grazers. These animals were not found in the wild, nor did they arrive of their own accord. They were taken from zoos, were once domesticated and have been confined within the 6000-hectare reserve. If these herbivores had arrived at OVP of their own accord (like the beaver) or had never been formally domesticated (like the deer in the nearby forests of the Veluwe) – then research could perhaps have been presented as merely observation. This would have been the 'Serengeti behind the dykes' that advocates imagined (see Belt 2004) with no veterinary obligations and very limited licence to intervene.

However, an alliance of animal welfare campaigners, hunters, politicians and journalists have argued that the cattle and horses are fundamentally made, or at least 'kept', animals that should be subject to the animal welfare associated with experiments in made spaces like laboratories, farms and abattoirs (see for example, Tweede Kamer 2010). This biopolitical debate centred on the welfare of the cattle and horses when food becomes scarce and some animals die of starvation. In 2005 the Dutch animal welfare organisation Dierenbescherming launched a court case in which their lawyers argued that Staatsbosbeheer (SBB) lacked the required permit and called for an 'end to the experiment' at OVP (Aarden 2005). The judge found in favour of SBB, accepting their argument that they no longer exerted 'factual power' over the animals (Rechtbank's-Gravenhage 2006). Here the absence/presence of a property relationship became the key determinant of the found/made status of animals. Through this rare revoking of animal property, the cattle and horses in OVP were classified as wild and SSB were relieved of any legal responsibility.

In practice this situation became a public relations disaster for SBB. A compromise was reached that seeks to reconcile and move beyond the conflicting demands of living with found and made animals. Here a wildlife ranger, armed with a rifle and silencer, patrols the OVP, identifying and killing those animals whose bodily condition and behaviour indicate that they would not survive the winter. This has been popularly termed population control with the 'eye of wolf'. In theory the ranger must become wolf to choose his prey, drawing on ethology and the skills and knowledges of the field sciences. In practice, as so little is known about wild bovine and equine behaviour (let alone their interactions with wolves), the scientific criteria used to assess the condition of individual cattle and horses are adapted from those used to judge the welfare of farm animals.[7] A novel set of relations have emerged here that conjoined practices associated with found and made sites. Drawing on Ingold, Klaver *et al.* (2002) present the de-domestication of large herbivores in the

Netherlands as the replacement of relations of trust over relations of dominance. Here the expertise of animals is valued and organisms and landscapes are given more scope to determine their own futures. This tentative compromise echoes Haraway's (2008) cosmopolitics of 'response-ability' towards the individual animal, the species it represents and the wider ecology it helps compose, aware that the best interests of all three do not always align. It offers a model for experiments in wild forms of interspecies companionship that appreciate the 'beastly places' (Philo and Wilbert 2000) of nonhuman life. These need not make recourse to the impossible spatiality of wilderness and ease the carceral confines of agricultural domestication.

Order–surprise

There are important differences between the conduct of wildlife conservation at OVP and the practices prevalent across much of north-west Europe, which relate in part to how each conceives and seeks to order emergent and unanticipated ecological properties (i.e. surprises). The dominant, equilibrium model of European paleoecology imagines landscapes tending towards a closed canopy forest that is currently kept in abeyance by agriculture and forestry. Low-intensity versions of which generate much of what is valued as biodiversity. This orderly biogeography informs a comprehensive infrastructure for identifying, monitoring, researching and nurturing various species and habitats. Here ecologies are linear and can be known and predicted. Hypotheses can be deduced and tested. Surprises are anomalous. Such Experiments generate scientific authority to legitimate policies to resist the depredations of modern land management.

Vera is one of a number of ecologists and conservationists who contest this paradigm. They argue that its paleoecology is inaccurate and suggest that its management prescriptions can be deadening in the face of accelerated climate change and the nonlinear responses of ecological forms and processes. It is in this intellectual and political context that Vera proposed his alternative, nonlinear 'theory of the cyclical turnover of vegetations' (2000, 376) with its dynamic 'ecological reference' of the forest–pasture landscape. According to the hypothetico-deductive method his theory could perhaps be used to establish hypotheses for testing in the field experiments at OVP (and an associated management plan to bring the alternative referent into existence). What is perhaps most surprising and different about OVP is the lack of prediction and management that has taken place. Until recently there have been no targets, no models and no explicit action plan.

Partly this absence is due to a lack of interest in (and thus funding for) ecological science from the government agencies that own and manage the site, and a wariness about drawing attention to the seasonal hardships of the large herbivores discussed above. More fundamentally, our interviews with site managers suggest a very different ethos toward field experiments. This is characterised by a conscious desire to escape some of the confines of the ordering practices that frame and perform European wildlife management. OVP became famous as a source of surprises and those interested in its ecology were keen to nurture and learn from its inadvertent ecological processes. Vera's theory of the cyclical turnover of vegetation, like other modes of nonequilibrium ecology, does not offer a linear trajectory towards a transcendent ecological order or a clear set of parameters that could be modelled to anticipate future changes.

Instead, Vera explained that in researching and managing OVP he needed to cultivate a more speculative approach. This aimed to grant a great deal of agency to certain nonhumans and the ecological and hydrological processes they perform in driving landscape change. He argues that this has generated a range of surprising ecological events and new ecological knowledge that challenges the existing paradigm. For example, the return of carrion encouraged a pair of rare white-tailed eagles to nest (formally) below sea level, displaying behaviours unanticipated by ornithologists. Marris (2011) describes OVP as an archetypal 'novel ecosystem' characterised by a rich, but non-analogue, ecology. Similarly, the de-domestication of the large herbivores has generated animal behaviours at both an individual and herd level that have never previously been witnessed by scientists in Europe. Cattle and horses at OVP display demographic structures, herd dynamics and individual coping mechanisms that confound experts on their domestic kin (Vulink 2001). These experiments with wildness at OVP approximate Gross and Hinchliffe *et al.*'s Rheinberger-inspired epistemology of experiments as speculative deliberations with nonhumans designed to generate and detect surprises. Here the inductive relations established with OVP frame the site as an uncertain 'wild thing', capable of putting accepted knowledge at risk. Sympathetic conservation biologists, like Sutherland (2002), welcome an increased 'openness' in conservation management.

The challenges of such speculative wildlife management are perhaps most clearly displayed in the efforts of conservationists at OVP to comply with the Natura 2000 legislation that governs conservation in Europe. Natura 2000 prescribes a natural order founded on the compositional ideal of a premodern ecology. It identifies a list of rare and/or threatened species and habitats that should be monitored, modelled and managed. The dynamics of their populations become the accounting framework for deducing the success or

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failure of landscape management. OVP accommodates a host of Natura 2000 target species, especially birds. However, conservationists at OVP are seeking to understand nonlinear ecological processes, not just species patterns. The annual dynamics of rare species have not been their primary concern. This has caused problems. In 1996 the population of rare spoonbills at OVP dropped from 300 breeding pairs to zero (Bosman 1996). These figures spread panic among the external ornithologists who detected it. Accusations were made that the increase in foxes at OVP as a consequence of high-levels of carrion, coupled with poor water-level management had led to the collapse (Nijland 2008). There were calls for a change in stocking densities and hydrological regimes. Eventually, the population at OVP bounced back and many of the displaced spoonbills were found to have moved out to colonise the wider network.

However, this event left SBB exposed. They had not predicted it, were not managing for it and could not offer comprehensive data to account for it. The successive independent commissions on the management of OVP have demanded that more be done to comply with Natura 2000. Calls are made for an improved 'statement of management objectives' and a 'system of environmental monitoring', including 'analysis and modelling to identify current processes, predict future trends and to set thresholds to acceptable change' (ICMO 2006, 13). Much of this advice aims to bring OVP in line with prevalent practice. It seeks to circumvent conditions of uncertainty, to rationalise the stochasticity that characterises the current management regime and to shore up the 'political epistemology' and authority of equilibrium ecological science. This advice engages in a form of anticipatory governance that seeks to foreclose surprises that might result in politically and ecologically undesirable eventualities.

For its critics the fluid, speculative approach to science and management displayed at OVP poses a series of administrative and political challenges. For example, on the other side of the Channel, an English Nature research report examining the implications of the Vera hypothesis dismisses it as much on the grounds of its bureaucratic inoperability and political risks as on its scientific merit (Hodder *et al.* 2005). Nonlinear processes are anathema to the audit culture of British conservation (Adams 1997). More significantly perhaps, other ecologists have argued that a lifting of management prescriptions creates space for less desirable emergent properties that might pose biosecurity risks – in the form of invasive species, dangerous predators and zoonotic disease (Groot Bruinderink *et al.* 2007). Letting go of a safely composed Nature might lead to economic risks and the local and global diminishing of biodiversity. Meanwhile, political opponents have offered criticisms that echo those put forward by James Evans (2011) in his review of a comparable shift towards open-ended experiments in the management of urban ecologies. Here the speculative management regime exemplified by OVP is feared as a Trojan horse for dismantling hard-fought pieces of environmental legislation and subsidy that protect culturally significant ecologies and marginal political economies in upland and other geopolitical marginal regions; this, they argue, is an experiment whose ends have been framed in advance (Turnhout 2003; Zomeren 1993).

As with tensions over the found–made status of OVP, the present settlement represents an uneasy compromise. SBB do enough to comply with the ordering requirements of Natura 2000, but resist efforts towards proactive management for designated species. In response to the criticisms of the second ICMO, SBB also published their first management plan for the OVP (Staatsbosbeheer 2011). They have beefed up their monitoring programmes to help anticipate, detect (and thus learn from) future surprises. Reading these documents carefully and attending to how they articulate and seek to guide field practice, we can detect evidence of knowledge practices that can attune and respond to a mutable and emergent world. In Steve Hinchliffe and his co-authors' terms, there is evidence here of a speculative mode of 'knowing around' (not a prescriptive 'knowledge of') wildlife, configured within a documentary infrastructure that offers a set of loose 'diagrams' for desired emergent futures (see Hinchliffe *et al.* 2005; Hinchliffe and Lavau forthcoming).

Secluded–wild

In contrast to the fairly open-ended deliberations with nonhumans that characterise the management of OVP, SBB have been reluctant to engage with interested Dutch publics in resolving the points of tension mentioned above. As a result they weren't able to prevent OVP becoming a site of controversy – characterised by high-profile and frequently antagonistic debates between public officials, scientists, birdwatchers, farmers and animal welfarists. In this final analytical section we draw on and develop Callon *et al.*'s (2009) criteria for evaluating the relationships between 'secluded research' and 'research in the wild' to critically examine the political processes through which OVP is governed. We aim to map its deficiencies and offer some lessons. Due to limited space we will focus on debates over the welfare of the large herbivores, which have posed the most fraught public relations challenges to SBB.

Public concerns for the welfare of the large herbivores at the OVP first surfaced at the end of the 1990s. Emaciated animals could be seen starving to death and images of their plight were soon circulating on television and more recently on the Internet. At this point

the Dierenbescherming initiated their campaign that was to culminate in a court case. The Dutch government responded to this controversy by assembling the first ICMO, who were charged with examining the management of the site and advising the government minister on how it might be improved. They published a series of recommendations in their first report in 2006. During the harsh winter of 2009 the cattle and horses were again seen to be threatened by starvation. The controversy flared up once more and the responsible minister (of Agriculture, Nature and Food Quality) was forced to answer questions about OVP in parliament. She felt compelled to make an emergency intervention to feed the starving animals. The ICMO were recalled and asked to evaluate SBB's performance and to make further recommendations on animal management. They published their second report in 2010, which summarises the 'governance situation' at OVP as follows:

> (the) management (of SBB) is not strongly driven by research and monitoring outcomes, little stakeholder engagement takes place in decision-making, little openness of the management to ongoing practices, all resulting in strong opposition of some societal groups against the current management strategy of the area. (ICMO2 2010, 84)

The ICMO argue that SBB are not conducting a 合法實驗
legitimate experiment. They first invoke the epistemological criteria used to evaluate secluded research, to argue that SBB is failing to comply with the fundamental Popperian requirement of seeking future falsification and requiring the full disclosure of data (Popper 1945). They suggest that there has not been enough transparency in the data collection and publication to qualify this as a rigorous laboratory experiment. Furthermore, by not stating an explicit protocol for testing a hypothesis, the management regime cannot be held to account. Turning to the public dimensions of the OVP controversy the ICMO then take SBB to task for not carrying out the 'stakeholder involvement' they explicitly advocated in their first report. SBB are presented as out of touch, unaccountable and undemocratic. This is a damning critique. In Callon *et al.*'s terms, OVP is neither 'secluded' enough to qualify as science nor 'wild' enough to be democratic. The organisation is caught in the middle and fails on two counts.

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The substance of these criticisms is illustrated in the on-going image wars relating to OVP. Here various parties have contested how the landscape and its animals should be visualised and understood. Prior to the animal welfare controversy, SBB were happy to present OVP as a secluded laboratory; a private space where scientists could experiment out of sight and without deliberation. But OVP is in the suburbs and much of the site can be overlooked from bordering dikes, roads and a railway line. Ornithologists with binoculars and animal welfarists with film cameras have found ways of seeing and visualising what is taking place. For example, the amateur films of animal starvation appear to have been shot at the perimeter of the OVP. Invoking an 'affective logic' (Lorimer 2010) associated with footage smuggled out of laboratories and slaughterhouses, they show starving and dead herbivores interspersed with iconography of captivity and implicit references to concentration camps. Their grainy quality and shock aesthetic serve to heighten the sense of illicit practice and foregrounds claims of abnegated responsibilities.[8]

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In response to these images and their political power, SBB and other rewilding advocates have changed tactics, promoting alternative visualities associated with field sites and nature reserves. For example, a photographer has been commissioned to produce a series of online videos exploring and explaining the OVP wildlife. His wildlife photography at the OVP has been published by SBB (Smit 2010). Targeted at the coffee tables of the Dutch middle class, it presents iconic plants and animals as denizens of the European wilderness. A feature length wildlife-documentary is currently in production and access to the OVP via jeep safaris and bird hides has been promoted, including exclusive bookings for high-end private events. A different (and highly popular) strategy has involved deploying web-cams to show the charismatic foxes of the OVP, evoking anthropomorphic features and familial narratives.[9] These visual rejoinders accentuate the found character of OVP as 'the Serengeti behind the dikes'.

While these images and practices constitute a form of public engagement, they continue to present OVP as a site that is accessed and known by a small cadre of scientists. There is a pressing need for further deliberation. In his work on coastal engineering in the Netherlands, Bijker (2002) notes that the formation of state-sponsored scientific commissions (like the ICMOs) is a popular technique in the Dutch 'technological culture' for deferring and/or delegating decisionmaking to already existing experts. The ICMO were charged with finding a technical and managerial solution, consulting with key stakeholders but not reflecting on the procedures by which decisionmaking about the management of OVP could and should take place. The successive commissions offer important first steps, but they are modest, conservative interventions. To use Callon *et al.*'s terminology, the ICMO is characteristic of a 'delegative' model of democracy reliant on the 'aggregation' of already existing expertise to answer a pre-existing question. There is little evidence here of their 'dialogic' model of research in the wild in which the composition and expertise of a collective decisionmaking body emerges through the

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deliberative process. Much of the ICMO critique of SBB centres on their perceived failure to control the ways in which the management of OVP has been made public and visible, not with the openness of the management procedures themselves. This is perhaps most clearly conveyed in tactics for public engagement promoted by the ICMO and deployed by SBB. The focus here has been public education, employing various 'experts in communications' to help frame the findings for external audiences.

While these attempts have gone some way towards persuading the Dutch public of the legitimacy of the experiment, the current approach is redolent of the 'deficit model' of public understanding of science that has been heavily criticised in the sociology of science. There is a great deal of scope here for creating new 'hybrid fora' for deliberation, like those developed and documented by Whatmore and her fellow researchers in their work on environmental knowledge controversies. Bijker promotes an extremely relevant example of this potential in his autobiographical account of conducting an experiment in 'public debate as an open learning process' (2004, 387) in the development of the Dutch nature development policy in the early 1990s. However, these techniques and past experience did not inform the remit of ICMO. They would help to expand the deliberative ethos so far cultivated by SBB in their experiments with the large herbivores to include a more-than-human collective of sociable actors and emergent forms of expertise.

Conclusions: wild experiments in the Anthropocene

This paper has drawn together disparate literatures on the geography of experiments and experimental approaches to science-politics to summarise and develop a mode of political ecology based around the concept of wild experiments. Experiments and experimentation have been in vogue across the social sciences in the last decade, including in geography. This paper welcomes these enthusiasms but cautions against a creeping lexical laxity in the use of such terms; it is sometimes difficult to conceive of what social changes are not experimental in this literature. Here we offer ways of specifying and differentiating expert-led experiments in the environmental sciences. First, according to where they take place and the difference these locatory properties make to their conduct. Second, by the relations that they establish with the human and nonhuman constituencies they concern. Linking these differences, the paper presents three of several possible axes for describing and evaluating real-world experiments: found–made, order–surprise and secluded–wild. The concept of wild experiments speaks to and helps develop a wider research agenda within and beyond geography. In conclusion we would like to specify some of these contributions and reflect on the utility and risks of adopting this framework for critiquing and designing forms of environmentalism for the Anthropocene.

In examining experiments as found–made we have principally been concerned with the epistemic properties of one specific locatory, the nature reserve. But OVP is not exemplary of reserves, which are generally conceived as 'found' compositional analogies of a prehistorical or premodern past. OVP is a nature reserve for the Anthropocene in the sense that it is willingly presented as a made site for knowing and experimenting with an uncertain future. It is uninhabited and uncultivated, but it is not purified. It is hybrid, in the sense that it is a knowing co-production of multispecies agencies. It serves as the inspiration and catalyst for the proactive 'development' of 'new natures' under a distinctly Dutch mode of conservation. Unlike the similarly hybrid, but specific, marginal and mundane sites described by Hinchliffe *et al.* and Gross, OVP is also a prestigious locale for doing environmental science and for demonstrating forms of management; it is a here that advocates would like to replicate everywhere.

Understood this way, OVP provides one means of moving beyond the paralysing politics of paradox in which much modern environmentalism and its critics seem locked (see Latour 2010). There is, and never has been, a singular Nature to which we can return or against which we can dispute the authenticity of a purported reconstruction. OVP offers an alternative to the stale found–made distinction about which such paradoxes depend. As we saw with the treatment of the de-domesticated animals and the future-orientation of Vera's ecological referent, it offers a space for wildness without the impossible geography of wilderness. Here is a promising ontology for the Anthropocene, where to rework Callon *et al.*'s terminology the wild is a multispecies commons.

Epistemologically, these deliberations with self-willed nonhumans align best with the second definition of an experiment outlined at the start of the paper. Although the contemporary ecology of OVP is presented as a test of Vera's hypothesis, in practice it is valued for its ability to surprise. Freed from the management prescriptions associated with ensuring convergence towards a transcendent equilibrium Nature, OVP generates non-analogue events, behaviours and ecologies. In some ways the management of OVP is similar to Rheinberger's experimental systems; an arrangement of materials designed to generate and learn from difference. The ecological management of OVP involves forms of practical expertise that are attuned to the diverse and surprising becomings of any ecological complex. OVP avoids a biopolitics of closure that is associated with orthodox forms of wildlife

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conservation premised on equilibrium ecology. What is taking place at OVP would therefore seem to have a great deal to offer environmentalism in the Anthropocene given the current uncertainties about the nonlinear ecological responses to accelerated climate change and the conditions of uncertainty that currently characterise research and planning for climate change adaptation. As a field site, OVP presents a much more public system than those documented in Rheinberger's laboratories. This is an experiment taking place in real time with even less clear boundaries.

Environments cast off from a fixed Nature and operating in the wild outside of the laboratory (or equivalent computer models) are inherently political. Nonequilibrium ecology offers few universal criteria for identifying failure or for specifying undesirable future scenarios, however self-willed. There are therefore political and ecological risks for natural and social scientists advocating a shift to immanence that are well illustrated in the OVP example. Many of the local opponents to what is happening at OVP are defending clearly specified natures, like those associated with animal welfare, the future of rare birds or the demise of the cultural landscapes they inhabit. These are familiar and commendable political projects with hard-fought territorial and legislative gains. There is a real risk that rewilding, with its purported open-ended ecology of surprises, could inadvertently play into the hands of those who would like to see them removed. As Evans (2011) rightly notes, fungible, laissez-faire neoliberal natures and fluid, self-willed ecologies are ontologically not that different. As such it is vital that in conceiving of the wild, in which the wild experiments at OVP take place, we keep sight of a set of wider debates about the current and future political ecology of Europe that will frame how they proceed and to what ends they are put.

As we mentioned previously, OVP has become a legitimating exemplar for the ambitious continental rewilding strategy named Rewilding Europe. On the one hand, it is heartening that the architects of this initiative have picked a project that is taking place at the core of Europe. OVP is not the familiar elite intervention foisted upon a geographically marginal community. However, the continental scale implementation of rewilding as imagined and performed at OVP demands a paradigm shift in conservation policy (and subsidy) away from the current model of 'land sharing' to a more segregated model of 'land sparing'. This shift would demand the intensification (or continued global outsourcing) of agriculture and the abandonment of the forms of agriculture currently practised elsewhere. The ecological merits of this change are currently subject to much debate (e.g. Phalan *et al.* 2011). Its possible future geographies and political ecologies will be thrashed out behind closed doors in Brussels in the coming years of Common Agricultural Policy reform. Given the current climate of austerity, rewilding could offer a convenient gloss for cutting expensive subsidies, waiving restrictive conservation legislation and even the accelerated implementation of markets in ecosystem services. While OVP might offer new modes of science for the Anthropocene and novel modes of human–nonhuman companionship, it is an experiment whose future outcomes – like many in the Anthropocene – are framed within a specific political-economic context. These are still early days, and such an outcome is by no means determined, but we should remain vigilant as to the ends to which such experiments (and geographers' support of them) are the means.

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Notes

1 The Anthropocene is a contested term, coined by Paul Crutzen (2002) to describe the contemporary geological era, which begins once humans became a planet-changing force.
2 We take the capitalised term 'Experiment' from Lane *et al.* (2010), who use it to denote a singular model of an experiment associated with modern Natural Science.
3 Wild Europe/Rewilding Europe is an initiative of WWF Netherlands, ARK Nature, Wild Wonders of Europe and Conservation Capital. It has received the bulk of its funding from these organisations and the Dutch and Swedish postcode lotteries. Other big European environmental NGOs – like the RSPB and the Wildlife Trusts – have also expressed an interest in rewilding.
4 The methodology for this paper comprised a review of academic, policy and popular literatures relating to the management of OVP, alongside a series of in-depth interviews with key stakeholders in Brussels and the Netherlands and participant observation with the ranger at OVP. The data were largely collected between February and August 2011, though the project team have made regular visits to the site since 2008.
5 For a critical analysis of this discourse of 'mouldability' and its political and cultural implications for the 'new natures' of the Netherlands see Drenthen (2009).
6 This process has had some success. Contemporary researchers now use data gathered at OVP to guide paleoecological investigations of relatively unmodified habitats in Europe. See for example research being conducted at the Oxford Long Term Ecology laboratory (http://oxlel.zoo.ox.ac.uk/). Accessed October 2012.
7 The reintroduction of the wolf and their important 'ecology of fear' is seen as a step too far by the managers at OVP, but wolves are expected by many to return to the Netherlands under their own steam in the not so distant future (see http://www.wolveninnederland.nl). Accessed October 2012.
8 See http://www.oostvaardersplassen-sterfte.nl/. Accessed October 2012.
9 See http://www.volgdevos.nl/. Accessed October 2012.

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