Forest Policy and Economics xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Forest Policy and Economics

journal homepage: www.elsevier.com/locate/forpol

Adapting through practice: Silviculture, innovation and forest governance for the age of extreme uncertainty

Anna Lawrence

University of the Highlands and Islands, Inverness IV2 5NA, United Kingdom

ARTICLE INFO

Article history:
Received 14 December 2015
Received in revised form 18 July 2016
Accepted 24 July 2016
Available online xxxx

Keywords:
Adaptive management
Experimentation
Organisational change
Scientific knowledge
State forest enterprises
Tree health

ABSTRACT

Adaptation in forest management is often framed as a scientific challenge, relying on more accurate modelling and better communication from science practice. However future scenarios of extreme uncertainty such as those characterising the Anthropocene may require a more flexible and interactive approach, drawing on a wider range of knowledge. The role of the practitioner in this is often highlighted, but little understood. This paper therefore seeks to contribute to empirical understanding of forest practice and its implications for adaptive forest governance. In the UK, devolved forest administrations are addressing new structures and politics, reduced budgets and staff, and several high impact tree health disasters. In the absence of scientific and operational guidance, foresters are finding new spaces in which to use their silvicultural knowledge, and work flexibly, generating new knowledge and practice through observation and local experiments. The capacity of state forestry organisations to learn and adapt is constrained by resource cuts, reorganisation, poor record keeping, increasingly top-down policy control, and de facto pre-eminence given to timber as the management objective. Individual relationships and personalities can nevertheless support communication and learning. The new circumstances are stimulating an approach which is both creative and grounded in silvicultural knowledge and experience. Important parts of the adaptive process lie with practice and innovation in the forest, rather than hierarchical, science-led approaches, but reality does not present us with a simple dichotomy between deterministic, reductionist forest management, and indeterministic, adaptive, ecosystem approaches. Further attention to practitioners' realities and contribution to knowledge is needed.

1. Introduction

Forest management systems have developed in close connection with forest science, and in the context of assumed environmental stability and predictability. Many believe that this assumption is no longer valid. In a new context of uncertainty about future climate and other conditions, forest science is refocusing to find technical solutions which may help to cope with uncertainty, such as uneven-aged stands, close-to-nature or continuous cover forestry, and changing species choices (Brang et al., 2014; O'Hara and Ramage, 2013; Schütz, 1999). The predominant response conforms with the conventional science-into-practice model, focusing on solutions that are science led, and highlighting communication gaps between science and practice (Bolte et al., 2009; D'Amato et al., 2011; Krantz et al., 2013; Lindner et al., 2014; Yousefpour et al., 2014). Forest scientists express concern about the challenge of advising forest decision-makers on how to plan (Lidskog and Lofmarck, 2015; Lindner et al., 2014) while forest managers call for locally relevant and credible climate change science to inform management (Blades et al., 2015).

Thus far, much of the science reflects the 'command and control' approach to forest management. But a growing body of scientific literature questions whether such top-down approaches are enough, or appropriate. The notion of the Anthropocene, as an era characterised by profound human alteration of Earth's systems and processes, predicts much greater instability and unpredictability for the behaviour of ecosystems (Kellie-Smith and Cox, 2011; Zalasiewicz et al., 2008). It has been suggested that, for forest management, such instability and uncertainty may imply a 'no analogue' future where past experience does not provide a guide to future behaviour (Sample and Bixler, 2014). In a 'no analogue' future, we cannot be sure of the answers, and may need to provide more space for the questions.

In contrast to the science-dominated view, a diverse body of literature proposes something more radical. These proposals come in different forms. One critique calls for a move from the 'confident ecological science of control' to a 'tentative and ambiguous science of coping' (Bavington, 2002). Another advocates managing forests as 'complex adaptive systems' characterised by diverse and connected components which are interdependent and show adaptation and self-organisation

E-mail address: anna.lawrence.ic@uhi.ac.uk.

http://dx.doi.org/10.1016/j.forpol.2016.07.011
1389-9341/

(Puettmann, 2011). A third contrasts 'deterministic' (reductionist, predictable) with 'indeterministic' (organic, adaptive, flexible) forestry (Wagner et al., 2014) which accepts and works with unpredictability, in ways that the traditional reductionist approach to forest science cannot. These critiques come from a range of intellectual traditions, but converge on the need for a move away from planned top-down decision-making. Instead of following hierarchical structures, and science-led silvicultural tables for planting, thinning and felling, forest managers would need to use initiative, assess risk, innovate and share findings. Such approaches challenge established positions and modes of decision-making: the roles of scientists and advisors, the culture of hierarchical planning and the wider command-and-control culture of forest management (Lidskog and Lofmarck, 2015; Rodela, 2013; Tittler et al., 2001).

There is a wider challenge in that implementation of these approaches would require changes in governance (decision making processes) and behaviour (implementing the decisions, and day to day practice). Keenan (2015) notes that adaptation requires 'multiple forms of knowledge and new approaches to forest management decisions' and advocates multi- and trans-disciplinary partnerships involving scientists, practitioners and local actors. Others highlight the need for researchers and managers to work in new roles (Bormann et al., 2007), and for an organisational culture which promotes a shared vision and innovation (Richter et al., 2015). Scientific reviews highlight the need for flexible approaches which support learning and capacity to change (Millar et al., 2007), and acknowledge that 'forest managers must be prepared to respond nimbly as they develop' (Park et al., 2014).

All this would result in profound changes in knowledge relations. How can such shifts work? One place to start is in understanding how forest management practitioners are changing what they do, and to work outwards from that to understand better how organisations constrain or enable innovative practice. It is often asserted that with increasing complexity and uncertainty there is increasing need to involve a wider range of stakeholders in forest management (Beratan, 2014), but practitioners themselves are rarely mentioned. Research on the gap between policy and implementation focuses on communicating science rather than on the knowledge and practices of forest managers (Archie et al., 2012; Lawrence and Marzano, 2014; Milad et al., 2013). We now know quite a lot about what forest managers perceive or believe (Seidl et al., 2016; Yousefpour and Hanewinkel, 2015) but not what they do. Resilience researchers call for 'more effective ways of capturing practitioners' experiential knowledge' (Beratan, 2014).

To summarise: forest analysts propose that a coming time of extreme uncertainty and instability (characterised by some as the 'Anthropocene') will make prediction and control difficult. Alternative models focusing on indeterminate, bottom-up management are advocated, and highlight the value of practitioners' knowledge and actions, but we know little about how forest managers are responding to uncertainty in practice. We also know little about how practice fits into organisational governance and in turn how forestry organisations translate decisions into action, to learn and evolve (Cheng et al., 2015; Doelle et al., 2012; Nelson et al., 2016).

This paper focuses on this need to understand practice empirically, and to consider what that means for forest governance. It looks at change in public (state) forest management in the UK, through the experiences of forest managers who are innovating to deal with complex ecological, social and political challenges (described below). It reflects on those changes and constraints, in relation to the discourses mentioned above, and asks whether a focus on practice helps to address some of the concerns mentioned above. The study focuses on state forest management because the governance context is quite different from that of private forestry. By focusing on state forest districts in three countries of the United Kingdom, we can explore a range of responses and adaptations within a shared organisational structure and culture.

2. State forest governance and silviculture in England, Scotland and Wales

The three countries of Great Britain (England, Scotland and Wales) are covered by the Forest Act (1967) which with the Plant Health Action (1967) sets out the roles of the Forestry Commission (FC), including prevention of loss of tree cover and illegal felling, environmental protection, protection of trees from pests and disease, and management of the state forests. The organisation of these roles has passed through various historical permutations, resulting in a clear separation of policy, regulatory and management functions in each country as discussed below.

In the late 1990s, following devolved government in Scotland and Wales, forest policy and management was also devolved to the new national administrations, and national forest strategies were prepared for each of England, Scotland and Wales (Forestry Commission 1998; National Assembly for Wales, 2001, Scottish Executive (2000). In 2002, the regulatory and operational functions of FC were divided into FC Scotland (FCS), FC England (FCE) and FC Wales (FCW), with some central functions retained by FC Great Britain (FCGB). Since then Wales has taken a further step, and in 2014 subsumed the former functions of FCW into a new agency, Natural Resources Wales (NRW) which also includes the former Environment Agency in Wales, and Countryside Commission for Wales.

The three roles of policy advice, forest management and forest administration/regulation are treated differently in the three countries. In England, the former detailed strategy has been replaced by a 'Forestry and woodlands policy statement', following a period of policy turmoil and uncertainty during which proposals to sell the public forest estate were robustly rejected by campaigners, leading to a retreat from the proposed policy changes (DEFRA, 2007, 2013; Lawrence and Jollands, 2011). Severe budget cuts from 2010 onwards have accompanied restructuring, reducing the number of districts to six very large ones.

Budget cuts and reorganisation have also affected Wales, following the reorganisation of FCW into NRW. At the time of research however, the Welsh Government Woodland Estate was managed through four forest districts while harvesting, marketing and restock functions were carried out by a national team. Wales has had relative policy stability since 2006 based on the 'Woodlands for Wales' strategy, but is struggling with the impact of enormous institutional change since 2014, which put forestry into a new context of being only a small part in a large environmental organisation.

Scotland has been less troubled by policy and organisational change than Wales and England, but budget cuts have had recent impact. The 'Scottish Forestry Strategy' has served as the policy base since 2006 and is widely respected and implemented (Scottish Government, 2006). District structures have been more stable than in England but have seen several mergers, so that the national forest estate is now managed by ten forest districts.

In all three countries, private and public forests are regulated by a body which is separate from the Forest Enterprise, but which historically has been part of the FC. In Scotland this is carried out by five conservancies, in England by five area offices, and in Wales by a national office.

The UK has recovered from a low point of 5% forest cover in the early 20th century, to an average of 13% forest cover, through concerted government action in the public sector, and incentives to the private sector, to plant forests of (largely exotic) conifers, with the result that more than half of the UK's forest cover consists of conifers (varying from 26% in England to 76% in Scotland), of which almost half are owned and managed by the public sector. At least 50% of these conifer forests are Sitka spruce (*Picea sitchensis)* monocultures; in Scotland 92% of all state forest is conifer, of which 61% is Sitka spruce (Forestry Commission, 2015). The prevalent forest management system is clearfell and restock, with growing interest in mixtures and continuous cover forestry (Cameron, 2015; Mason, 2015; Mason and Connolly, 2014).

Please cite this article as: Lawrence, A., Adapting through practice: Silviculture, innovation and forest governance for the age of extreme uncertainty, Forest Policy and Economics (2016), http://dx.doi.org/10.1016/j.forpol.2016.07.011