Available online at www.sciencedirect.com
SCIENCE DIRECT®
Landscape and Urban Planning 75 (2006) 155–161
LANDSCAPE AND URBAN PLANNING
This article is also available online at:
www.elsevier.com/locate/landurbplan

Editorial

Landscapes and sustainability

Landscape issues are frequently discussed in the context of sustainability, but it is often not clear what contribution Landscape Ecology, as a discipline, makes to the general sustainability debate. Do we as landscape ecologists merely make reference to sustainability to legitimise what we normally do? Or does a landscape perspective provide something that is distinctive or unique in terms of the way we frame sustainability issues or resolve them? The aim of this special issue of *Landscape and Urban Planning* is to explore this question by bringing together papers by authors from across the science–social science spectrum to debate the concept of sustainability and landscape. The focus of this issue is to discuss the relationships between ecosystem structure and function at the landscape scale and the outputs of environmental goods and services.

The stimulus for putting together this volume was a symposium held as part of the Sixth World Congress of the International Association for Landscape Ecology that took place in Darwin, Australia in July 2003. It contains extended versions of some of the papers presented at the session on sustainable landscapes and natural capital, together with one of the conference keynote papers that was especially relevant to the topic.

1. Bridging theories

The introductory paper in the volume looks at the ways in which the landscape agenda has changed since the Earth Summit in Rio de Janeiro and in particular what new research issues emerged following the Earth Summit in Johannesburg in 2002. The two summits are useful reference points, not only because they provide important stimuli in themselves, but also because they reflect wider debates in the research and policy communities, and thus help us see how the research and policy concerns are changing.

In their contribution, Potschin and Haines-Young (2006) argue that although the outcomes of the Johannesburg Summit restated the concerns of the first Earth Summit, it is not 'business as usual' for Landscape Ecology. They suggest that the more equal emphasis given to the environmental, economic and social 'pillars' of sustainability in the Johannesburg Declaration reflects wider shifts in thinking about the form and content of science in the context of sustainability. This, they suggest is also illustrated by recent calls by Kates et al. (2000, 2001) and Gallopín et al. (2001), for a new science of sustainability, which is more transdisciplinary in its conception than traditional science, straddling not only the science–social science divide, but also the gap between the professionals and lay communities (see also Tress et al., 2001).

Potschin and Haines-Young (2006) are not alone in suggesting the need to refocus the research agendas of Landscape Ecology. Elsewhere, for example, Tress et al. (2005) have also described pressures for change within the discipline, reflecting a shift in priorities initiated by the need to understand nature–society relationships better. The challenge, which they suggest that we now face, is to develop 'bridging theories' that would allow us to understand and better represent patterns and processes across the nature–society interface.

0169-2046/$20.00
doi:10.1016/j.landurbplan.2005.03.006

The core issues of sustainability science focus on the interactions between nature and society and concern such issues of what determines both the resilience and vulnerability of such systems and what kinds of factors constrain their development. Such issues, Potschin and Haines-Young (2006) argue, should have a particular resonance for Landscape Ecology because for most of them an understanding of the configuration of landscapes and how landscape pattern and process interact at local, regional and global scales is likely to be fundamental in their resolution. They add, however, that solutions require a broader approach to Landscape Ecology, that encompasses the social and economic as well as the more traditional biophysical. It is proposed that the concept of natural capital and the analysis of ecosystem goods and services at the landscape scale might be one way of developing the kind of research agenda that seem to be required.

Landscape Ecology has traditionally focussed on the analysis of landscape structure with landscape conceived very much as a mosaic of land cover or habitat objects whose spatial pattern was significant in some profound sense. The natural capital paradigm suggests that it is not so much the objects themselves that are important, as the natural functions they support or sustain, and ultimately the goods and services they provide for people. According to Potschin and Haines-Young (2006), a sustainable landscape is one which is able to maintain the outputs of ecosystem goods and services that people value or need, and that the key research focus for Landscape Ecology is to understand the biophysical, social and economic boundaries of the space in which this is possible.

A problem that we must face in developing the idea of natural capital is that methods and data for the valuation of ecosystem goods and services are still in their infancy. The issue is addressed by De Groot (2006), who develops a framework for the integrated assessment of the ecological services and socio-economic benefits natural and semi-natural ecosystems and landscapes.

The approach suggested by De Groot (2006) is based on the idea that the problem of valuation can be approached by translating ecological complexity into a set of limited number of ecosystem functions that generate the goods and services valued by people. The paper builds on an earlier formulation (De Groot et al., 2002) which suggested that the major functional groupings were regulation, habitat, production and information by adding a new category, that of the 'carrier function'. The latter group, it is suggested, is particularly important in the context of systems dominated by people. The earlier model was focused mainly on natural and semi-natural ecosystems. Carrier functions cover such activities as cultivation, habitation and transportation, which require space and a suitable substrate, such as soil, to support the activity.

The important contribution that the paper by De Groot (2006) makes is that it shows how the functional approach can be applied to both ecosystems and landscapes. Using frameworks such as the one suggested, he envisages that functions can be assigned to different landscape units so that their ecological, social and economic values can be determined in terms of their contribution to the overall output of goods and services from an area. Since, in most landscapes, each landscape unit may play a role in supporting a range of functions, the approach also offers one way of representing in a spatially explicit way, the idea of a multifunctional landscape.

In the final part of his paper De Groot (2006) shows how his functional analysis can be applied to a real world problem, namely that associated with the management of wetlands on the Dniester Delta, on the north western coast of the Black Sea. The case study illustrates how the approach can support participatory approaches to conflict resolution and planning, and thus perhaps how we design tools and approaches that address issues that arise across the human-nature interface. One view of the functional approach illustrated is, therefore, that it begins to show us what 'bridging theories' from a new styled Landscape Ecology might look like. Through them, it seems, we might also begin to glimpse a vision of what a sustainable, multifunctional landscape might be.

2. Can landscapes be sustainable?

Less we think that the development of landscape ecological theories that bridge the nature–society interface is easy, we must temper any enthusiasm by considering the proposition made by Antrop (2006), that whole notion of a sustainable landscape development may involve a contradiction. The contradiction arises, he suggests, because landscapes continuously evolve

'. . . in a more or less chaotic way' that reflects social and economic needs. Landscapes, in his view, may contribute to sustainability, but they are not sustainable *in themselves*.

Antrop (2006) develops his argument from an analysis of the concepts of natural and human capital, which he thinks basically focus on the problem of sustainable economies. Within these paradigms he sees no explicit or direct relation to the idea of landscape, which is relevant indirectly insofar as it can help us understand the important qualities or characteristics of an area when making planning or conservation decisions. The concepts of natural capital and sustainable landscapes, he suggests, fit squarely with the 'ecological' as opposed to the 'semiotic' discourses recognised by Cosgrove (2002), insofar as they deal with landscape in terms of the interactions between nature and society, rather than with landscape in terms of its cultural meanings. For him the importance of the notion of landscape is that it integrates both 'material-physical reality' and 'immaterial existential values and symbols'.

Landscapes in which people are dominant certainly mirror social and economic needs and priorities, and as these change it is likely that these cultural landscapes will also be transformed. Thus, there is a sense in which it is unlikely that landscapes can ever be sustainable, except where we attempt to adopt an overtly conservationist approach. However, merely because notions of natural and human capital make little explicit mention of landscape, it does not follow that Landscape Ecology, as a discipline is somehow marginal to the wider debate. Indeed, it could be argued that the idea of a landscape provides a useful arena in which questions about the relationships between nature, economy and culture can be viewed.

Antrop (2006) acknowledges that the meaning of landscape is in a 'profound transition', and suggests that concepts, such as natural, human, social or quality of life capital are expressions of the broadening process that seems to be underway. He concludes that if these frameworks allow us to understand in precise ways the important qualities of landscape, and the context in which change is occurring and how they will fare in the future, then the idea of sustainable landscapes is no fiction. The danger he sees is that without precise time horizons for landscape management they will remain utopian.

3. Spatial pattern matters

If Landscape Ecology is to make a significant and distinctive contribution to contemporary debates about sustainability, then it is likely to be built on one of the discipline's core assumptions that *spatial pattern matters*. This line of argument is opened up by the paper by Blaschke (2006), who cautions against too rash a fusion between the natural capital paradigm and the more traditional analysis of landscape structure that characterises the discipline.

Blaschke (2006) critique develops from the suggestion by Potschin and Haines-Young (2006) that if sustainability at the landscape scale is mainly viewed in terms of maintaining the output of goods and services, then probably many different landscape configurations can be regarded as sustainable. Thus, planning solutions merely have to be 'adequate' rather than 'optional', so that the key task for Landscape Ecology is to understand the extent of the choice-space within which decisions can be made. Blaschke (2006) argues that spatial pattern matters fundamentally because context can have a fundamental influence of meaning and value. Moreover, landscape structure, he suggests is important in its own right, because different structures have different implications for processes. By implication, therefore, planning in the context of sustainability must not only take account of the outputs of goods and services, but also the nature of landscape patterns as an issue in its own right. If we only focus on outcomes in terms of benefits how, he asks, are we to help people with the issue of where to place things?

Following a review of the object-based GIS tools that are now available to the landscape ecologist, Blaschke (2006) argues that, in contradistinction to the anthropocentric arguments developed in favour of the natural capital paradigm (Haines-Young, 2000), the patch-matrix-corridor model of Forman (1995) still offers much that is of value to Landscape Ecology. He suggests that this may provide the key to understanding land use systems and land use changes through the development of structural or spatial indicators that can sit alongside other sustainability measures that cover the economic, social and cultural aspects of sustainability.

The suggestion that to explore questions about sustainability we should mainly look at landscape in terms of the output of the goods and services does not, how-

ever, imply that spatial pattern is irrelevant. Landscape structure often has a fundamental connection with process, and the analysis of structure is often fundamental to any understanding of ecosystem integrity and how ecological systems can be maintained so that they continue to deliver benefits to society. The main point of difference it seems depends on the question of whether in the context of a multifunctional landscape, there is an optimal pattern or spatial arrangement of landscape elements that science seeks to discover (Forman, 1995) or a larger set of landscape configurations that are 'adequate' or 'sufficient' in terms of the outputs they can maintain. Whatever position we take on this question, it seems inescapably the case that spatial pattern does matter.

In the contribution by Bailey et al. (2006) to this volume is particularly important in showing what new insights can be developed by landscape ecologists by linking the notions of natural capital with traditional approaches to the analysis of landscape structure and function. The case study that these authors present concerns how, in the context of expanding the semi-natural woodland cover in the Chilterns in England, the natural capital benefits of habitat creation can be maximised by a system of spatial targeting.Using GIS techniques Bailey et al. (2006) develop a set of spatially explicit criteria that can be adopted to measure how the potential benefits of native woodland vary across the agricultural landscapes of the Chilterns. The benefits they consider include not only biodiversity, but also functions, such as carbon storage, recreation, landscape health and employment. They show how by targeting habitat creation, the delivery of these natural capital benefits can be enhanced without compromising biodiversity goals.

A second example of how spatial analysis can be used to model natural capital is provided by Haines-Young et al. (2006) in this volume, who consider strategies for grassland habitat creation on the South Downs of England. In this case, they show that targeting schemes may be very different if other benefits, such as recreation, are considered alongside the more traditional one of biodiversity. The different conclusions reached in this study and that of Bailey et al. (2006), are only of local significance. What is more important is that both studies show that Landscape Ecology's traditional concerns with spatial structure can be a useful way into the analysis of natural capital. The study by Bailey et al. (2006) is particularly excellent in this respect. It provides an example of what De Groot in his contribution to this volume was proposing, in terms of assigning ecological, social and economic values to different landscape units to determine the overall output of goods and services from an area.

Although GIS can be used to model the spatial aspects of natural capital, the assignment of values is not, however, a mechanical exercise because fundamentally people have to involve. As the paper by Brunckhorst et al. (2006) shows, the question is what spatial framework we should use to represent the social, economic and biophysical values is often a complex one and may involve some analysis of stakeholders' views and beliefs if it is to be resolved.

Brunckhorst et al. (2006) argue that 'civic engagement' is essential to the resolution of sustainability issues, and if this is to achieve then resource managers must be able to represent the environment to people in ways that they understand. This paper shows that the problem of 'understanding' relates not only to the way environmental systems work, but also to the way they are framed in space. For an area in the northern part of the State of New South Wales, Australia, Brunckhorst et al. (2006) consider how people regard different areas as part of "their community", and how these regions compare to those generated either by the analysis of the biophysical structure of the region (e.g. catchments), or administrative boundaries, which are the frameworks most often used by resource managers.

Brunckhorst et al. (2006) demonstrate that, for the case study area, the boundaries of biophysical or administrative regions do not coincide with the way communities see their area, so that these more conventional units may be an impediment to achieving the engagement of local people. Instead, they suggest, natural resource management frameworks should define 'eco-civic' regions, that more closely align biophysical and cultural perspectives.

The construction of spatial network of eco-civic regions that is illustrated in the Australian example is reminiscent of attempts elsewhere to identify units, which are better able to capture a 'sense of place' than traditional biophysical representations. In England, for example, Swanwick (2004) has described how the technique of landscape characterisation, can be used to identify what makes an area locally distinctive, and how such approaches feed into a more holistic notion

of ‘countryside character’, that combines biophysical, cultural and economic dimensions. In this issue Crow et al. (2006) show how two different communities in Chicago, USA perceive contrasts in the structure of the urban landscape, and how this shapes the values they assign to trees in the city.

4. Past and present landscapes

Although the analysis of spatial pattern can help us understand how a landscape might generate the goods and service that people value, the analysis of pattern must be set against the fact that all landscape are subject to change. Thus, beyond questions about spatial structure and function, we must identify what it is that we are able or need to sustain over time.

An investigation of the relationships between the temporal aspects of landscape and natural capital is the focus of the contribution of Käyhkö and Skånes (2006) in this volume. The contribution of this paper is significant because it argues that Landscape Ecology should move away from the mere description of spatial pattern at one, fairly arbitrary point in time, and develop a better understanding of the dynamics of landscape elements. This, they suggest, can be done through ‘Landscape Change Trajectory Analysis’, which seeks to describe in a systematic way, how landscapes change and how ‘history’ is embedded in the structures we see at any one point in time.

The Landscape Change Trajectory Analysis is illustrated by Käyhkö and Skånes (2006) by reference to case studies from Ruissalo Island in southern Finland, and Virestad, southern Sweden. Both areas are valuable because they have a good archive data that can be used to reconstruct the history of these landscapes. The authors argue that if we are to exploit these types of data fully, we need to move beyond the simple characterisation of change as a series of separate time slices. The goal should be to create a spatio-temporal framework, which expresses the different ‘life-lines’ or trajectories of the elements that make up the landscape at any one point in time, which they suggest, is essential to understanding the landscapes that we inherit from the past.

The paper by Käyhkö and Skånes (2006) is also interesting technically because it illustrates how GIS can be used to analyse and represent a landscape’s ‘time-depth’. It is also important scientifically because it demonstrates how an understanding of the temporal trajectories of landscape elements can explain both their present characteristics and the contrasts we find between them. For example, in both case study areas, the authors show that the present day species composition of different landscape elements can be explained by such factors as their degree of habitat continuity over time. The dynamics of the boundaries between landscape elements is also shown to have a strong influence on their present day conservation status.

The major limitation of the proposal that we should take account of landscape trajectories is that we do not often have access to such a rich body of historical information as was available for the two Scandinavian case studies. Nevertheless, the ideas about landscape continuity, similarity, cohesiveness and hierarchical organisation that emerge from this type of analysis can do much to inform present day approaches to planning sustainable landscapes. For, as Opdam et al. (2006) argue in the final contribution to this volume, if landscapes are to be ecologically sustainable, we must ensure that future landscape structures support the processes required for the landscape to deliver biodiversity services for present and future generations.

Opdam et al. (2006) address one of the key challenges that planners face, which is to find methods of relating ecological sustainability to the interests of people and the economy. Their analysis of ecological sustainability is mainly focused on the conservation of species diversity, which they suggest is dependent upon fulfilling a number of important conditions. These include: the need to ensure that in planning a landscape, spatial pattern must support the processes required to maintain ‘resilient populations’, that planning should ensure that the changes to pattern initiated by development should not ‘push the long-term persistence probability to an unacceptably low level’, and finally that planners should communicate the issues effectively to all stakeholders.

The conditions that must be met in planning an ecologically sustainable landscape, Opdam et al. (2006) suggest, are often poorly met by planners, because the targets for conservation of species diversity are not well specified. In addition, we lack methods of relating site level decisions to the problem of maintaining a ‘coherent ensemble of sites’ in the wider landscapes, so that we may ‘spread the risk of local change’ across an

area. In order to overcome these difficulties, Opdam et al. (2006) propose that planners should use the concept of an ecological network as a framework for design and decision-making.

An ecological network is, according to Opdam et al. (2006), 'a set of ecosystems of one type, linked into a spatially coherent system through flows of organisms'. Since most landscapes contain several ecosystem types, more than one network can occur within the same area. They, thus, offer an interesting perspective against which notions of about the structure of multifunctional landscapes can be considered.

Opdam et al. (2006) compare the concept of the ecological network to other spatial design structures and argue they have a number of advantages. For example, they can help overcome the problems associated with fragmentation, and they can provide a framework in which more adaptive management strategies can be developed. The case study materials that they present, for Cheshire, England, also illustrates that the concept can be useful in communicating ecological ideas to stakeholders.

5. Multiple perspectives

Opdam et al. (2006) suggest that a key feature of ecological networks is that they can have different configurations and still serve the same goal. This they suggest is important because in dealing with landscapes with many stakeholders, the best ecological design may not be the one, which best corresponds to the demands of people. Thus, planners need to present a series of alternative solutions that all guarantee sustainable ecological solutions, so that choices can be made.

The problem of choice between alternative landscapes described by Opdam et al. (2006) brings the discussion of this editorial full circle, in that it returns us to the proposition described at the outset, namely that in planning for sustainability, we need to find ways of identifying the set of possible landscapes that can maintain the outputs of goods and services that people value, rather than to developing optimal design solutions (Potschin and Haines-Young, 2006). Clearly, there is still some way to go before this aim can be realised. However, a reading of the papers in this issue illustrates that contemporary Landscape Ecology now has some of the tools needed. The papers demonstrate how the concept of natural capital can provide a framework for examining both the links between biophysical processes and human values and the multiple perspectives that are found in most real landscapes. As such, we suggest, it is one avenue that the discipline can now usefully explore in its search for the 'bridging theories' that we need to understand better the relationships between nature and society at the landscape scale. The natural capital paradigm is one that can help landscape ecologists explain the nature of landscape change to people and, more importantly, why these changes might matter.

Acknowledgements

We would like to thank the conference organiser, especially Diane Pearson and Richard Hobbs for their help an input into the Symposium at a very busy time during the IALE World Congress in Darwin 2003. Also a special thanks to all the speakers at the Symposium for their contribution to the general debate. We are also grateful to the anonymous referees who gave valuable critical input to the manuscripts that make up this volume.

References

Antrop, M., 2006. Sustainable landscapes: contradiction, fiction or utopia? Landscape Urban Plan 75 (3–4), 187–197.

Bailey, N., Lee, J.T., Thompson, S., 2006. Maximising the natural capital benefits of habitat creation: spatially targeting native woodland using GIS. Landscape Urban Plan. 75 (3–4), 227–243.

Blaschke, T., 2006. The role of the spatial dimension within the framework of sustainable landscapes and natural capital. Landscape Urban Plan. 75 (3–4), 198–226.

Brunckhorst, D., Coop, P., Reeve, I., 2006. 'Eco-civic' optimisation: a nested framework for planning and managing landscapes. Landscape Urban Plan. 75 (3–4), 265–281.

Cosgrove, D., 2002. Landscape and the European sense of sight—eyeing nature. In: Anderson, K., Domosh, M., Pile, S., Thrift, N. (Eds.), Handbook of Cultural Geography. SAGE Publications, London, pp. 249–268 (Chapter 12).

Crow, T., Brown, T., De Young, R., Smith, J., Taylor, J., 2006. The Riverside and Berwyn Experience: contrasts in landscape structure, perception of urban landscape, and their effects on people. Landscape Urban Plan. 75 (3–4), 282–299.

De Groot, R., 2006. Function analysis and valuation as a tool to assess land use conflicts in planning for sustainable, multifunctional landscapes. Landscape Urban Plan. 75 (3–4), 175–186.

De Groot, R.S., Wilson, M.A., Boumans, R.J., 2002. A typology for description, classification and valuation of ecosystem functions, goods and services. Ecol. Econ. 43 (3), 393–401.
Forman, R.T.T., 1995. Land Mosaics: The Ecology of Landscapes and Regions. University Press, Cambridge.
Gallopín, G.C., Funtowicz, S., O'Connor, M., Ravetz, J., 2001. Science for the twenty-first century: from social contract to the science core. Int. Soc. Sci. J. 53 (2), 219–229.
Haines-Young, R.H., 2000. Sustainable development and sustainable landscapes: defining a new paradigm for landscape ecology. Fennia 178 (1), 7–14.
Haines-Young, R.H., Watkins, C., Wale, C., 2006. Modelling natural capital: the case of landscape restoration on the South Downs, England. Landscape Urban Plan. 75 (3–4), 244–264.
Kates, R.W., Clark, W.C., Corell, R., Hall, J.M., Jaeger, C.C., Lowe, I., McCarthy, J.J., Schellnhuber, H.J., Bolin, B., Dickson, N.M., Faucheux, S., Gallopin, G.C., Grübler, A., Huntley, B., Jäger, J., Jodha N.S., Kasperson, R. E., Mabogunje, A., Matson, P., Mooney, H., Moore, B., III, O'Riordan, T., Svedin, U., 2000. Sustainability science. Research and assessment systems for sustainability program. Discussion paper 2000-33. Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, Cambridge Mass, 20 pp.
Kates, R.W., Clark, W.C., Corell, R., Hall, J.M., Jaeger, C.C., Lowe, I., McCarthy, J.J., Schellnhuber, H.J., Bolin, B., Dickson, N.M., Faucheux, S., Gallopin, G.C., Grübler, A., Huntley, B., Jäger, J., Jodha, N.S., Kasperson, R.E., Mabogunje, A., Matson, P., Mooney, H., Moore III, B., O'Riordan, T., Svedin, U., 2001. Sustainability science. Science 292, 641–642.
Käyhkö, N., Skånes, H., 2006. Change trajectories and key biotopes–assessing landscape dynamics and sustainability. Landscape Urban Plan. 75 (3–4), 300–321.
Opdam, P., Steingröver, E., van Rooij, S., 2006. Ecological networks: a spatial concept for multi-actor planning of sustainable landscapes. Landscape Urban Plan. 75 (3–4), 322–332.
Potschin, M., Haines-Young, R., 2006. "Rio + 10", sustainability science and Landscape Ecology. Landscape Urban Plan. 75 (3–4), 162–174.
Swanwick, C., 2004. The assessment of countryside and landscape character in England: an overview. In: Kevin Bishop, K., Phillips, A. (Eds.), Countryside Planning: New Approaches to Management and Conservation. Earthscan, London, pp. 109–124.
Tress, B., Tress, G., Décamps, D., d'Hauteserre, A.-M., 2001 (Guest Editors). Bridging human and natural sciences in landscape research. Special Issue of Landscape and Urban Plan. 57 (3–4), 137–300.
Tress, B., Tress, G., Fry, G., 2005. Key steps for reaching integration. In: Tress, B., Tress, G., Fry, G., Opdam, P. (Eds.), From Landscape Research to Landscape Planning: Aspects of Integration, Education and Application. Springer, Wageningen, UR Frontis Series.

Marion B. Potschin, at present deputy director for the Centre for Environmental Management, and senior research fellow in sustainability and Landscape Ecology at the School of Geography, University of Nottingham. Before moving to the UK she worked for 13 years at the Institute for Landscape Ecology and Physical Geography in Basel/Switzerland, where she obtained her PhD (1995, Soil Water chemistry in Spitsbergen) and her professorial degree (Habilitation 2002, Sustainable Landscape Development), BSc, MA from Mainz/Germany and an additional MA in Glacial Geomorphology from Carleton University (Ottawa/Canada). As a result of her experience at MGU (human–society–environment), which is an interfaculty institute at the University of Basel, she is committed to inter- and transdisciplinary approaches to research and teaching in Landscape Ecology. She is currently general secretary for the International Association for Landscape Ecology (IALE).

Roy H. Haines-Young is professor of environmental management and director for the Centre of Environmental Management in the School of Geography, University of Nottingham. He holds a BSc in geography (Sussex), a masters in information technology (Nottingham) and a PhD (Kings College London). His research focuses on issues of sustainable landscape management, landscape monitoring and the philosophy of the natural sciences. His landscape ecological work is supported by funding from Central Government Departments and their Agencies in the UK, and the EU. At Nottingham he teaches in the area of Landscape Ecology, environmental management and GIS.

Marion B. Potschin *
Roy H. Haines-Young
Centre for Environmental Management, School of Geography, University of Nottingham, University Park, Nottingham NG7 2RD, UK
* Corresponding author. Tel.: +44 115 8467398; fax: +44 115 9515249
E-mail address: Marion.Potschin@Nottingham.ac.uk (M.B. Potschin)

Available online 11 July 2005