Celebrating Diversity: Adaptive Planning and Biodiversity Conservation

Nina-Marie E. Lister & James J. Kay
Environment and Resource Studies
University of Waterloo
Waterloo, Ontario,
Canada, N2L 3G1

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We are only now becoming aware of the complexity and surprising dynamics of the living environment. The paradox of biodiversity science is that the more knowledge we acquire, the more uncertainty we encounter -- which renders planning for conservation a sticky business indeed.

Biodiversity conservation in Canada is being undertaken by all levels of government, and by many non-government organisations (such as the Nature Conservancy of Canada, the Federation of Ontario Naturalists, and the Evergreen Foundation). The primary means of protecting biodiversity are “in-situ” methods -- that is, in their natural setting, in protected areas. Indeed, most conservation initiatives world-wide are based on protected areas, set aside because of natural heritage or economic resource values, or to protect species classified as endangered, threatened, vulnerable or rare. In Canada, most protected areas are found within national and provincial parks systems. Local Environmentally Significant Areas, Ecological Reserves, Areas of Natural and Scientific Interest, Conservation Areas, and several World Biosphere Reserves also form part of the public protected areas network. However, the degree of biodiversity conservation depends largely on the definition of “protection” afforded by each type of area.

There are three key problems with this current approach. First, policies and plans do not generally reflect emerging scientific perspectives on ecosystems as complex and uncertain, and in which change is inevitable and normal. Second, values for biodiversity are often hidden within the decision-making process. Third, the set of policy tools for conservation planning remains largely dominated by expert-led, prescriptive, regulatory methods which rely almost entirely on publicly-funded parks and protected areas. More creative approaches are needed if Canadians are to meet their national and international commitments to biodiversity protection.[1]

This chapter will consider an emerging approach, known as adaptive planning and management -- an approach characterised by flexibility in learning through change, integration of new science with values, and resilience through a diversity of innovative tools, methods, and perspectives. A case example of the Huron Natural Area in south-western Ontario will demonstrate a practical application of an adaptive planning approach.

Becoming Flexible: Embracing Uncertainty and Complexity in Ecosystems

Until recently, most ecologists believed that ecosystems follow a linear path of development towards a particular, biologically diverse, and stable “climax” state. However, within the past 15 years, research has shown this view to be incomplete.[2] While ecosystems do generally develop from simple to more diverse, complex states, they may develop along any of many possible paths and states, or even flip suddenly into entirely new states. Ecosystems are cyclic and dynamic systems, marked by often sudden, unpredictable change.[3] Diversity, complexity and uncertainty are normal, and we can not predict exactly how or when ecosystems will change.

However, these insights are not yet reflected in biodiversity policy and planning.[4] Most planning and management is based on the assumption that more knowledge leads to certainty, and therefore, predictability. While this is certainly true in certain deterministic science and engineering applications (such as mechanical physics and transportation engineering), it is not the case with complex living systems. Given what we are learning about ecosystem complexity and dynamics, it is clear that we cannot predict how ecosystems will evolve, change and behave, because they are complex systems and as such, are inherently unpredictable. Of course, this does not mean we should give up trying to plan and manage entirely. Rather, we must accept and embrace change as a normal part of life.[5]

Insights from science should be fundamental to adaptive planning. This requires closer links between ecological science and conservation. Three strategies for doing this are to: 1. broaden the scientific basis of conservation, to include all scales of biodiversity, not just species; 2. When arguing for biodiversity conservation, stop relying on the assumption that biodiversity makes ecosystems stable, and instead note the important ecological roles played by biodiversity; and 3. link conservation policies to experimentation, action research, and learning-by-doing.

Beyond Species

Biodiversity exists at all levels of the ecological hierarchy: from genes, to species, populations, communities, landscapes, and eventually biomes or whole ecosystems. Furthermore, biodiversity varies according to ecosystem perspective (or “type”), and the associated organising process. For example, the organising process for watersheds is water flow; for foodwebs it is nutrient and energy flows; and for species, it is reproduction. The notion of biodiversity as hierarchical is well-established amongst ecologists, and is integral to their newer work in ecosystem ecology. The implication of this view is that what happens on one level will not ncessarily occur at another.[6] For example, loss or addition of a species may not affect the diversity of communities within a landscape, or the diversity of a foodweb, but clearly affects species diversity. Planning and management must therefore target the appropriate ecosystem scale and perspective, and must be supported by science done at a relevant level. Thus, research on individual species may not be applicable to management of communities, foodwebs or entire landscapes. By the same token research into ecological communities or landscapes may not provide much direct insight into species diversity issues. Yet all these forms of diversity are important.

However, most conservation plans and policies have tended to focus on species.[7] This is likely because species are the most tangible, visible aspects of biodiversity. They are comparatively easy to measure, and much more research has been done on them than on other aspects of biodiversity. Many species also have a good deal of public appeal and can help "sell" conservation. This is particularly evident with large mammals such as bears, big cats, or caribou. The World Wildlife Fund, for example, has long known that people are more likely to open their hearts (and wallets) to conservation for the sake of cuddly bears or beautiful birds.

It is also widely believed that by protecting the habitat of the largest, longest-living, or most ecologically important ("keystone") species, other species will also be protected.[8] However, this "umbrella" assumption often leads to habitat protection that does not always result in the target species being conserved.[9]

Ecologists do not all agree on the importance of particular species to ecosystems. Some argue that all species play significant roles, and that it would be a serious mistake to conserve only those species considered most critical. Others, however, suggest that most species are redundant, and only a fraction of them are critical to ecosystem structure and function.[10] These contrasting views leave planners with a conundrum: ecosystems may collapse before it is known which species are expendable.

This debate over the role of species in ecosystems is the product of a misguided search for simple rules to describe complex systems. To ask “which species play which role” is the wrong question. It assumes the system is static, and that the relationships between species is static. In an ecosystem which is constantly reorganising and evolving, so too are the relationships and roles of species. At one time a species may be crucial, but at other times appear unimportant. For example, after a disturbance in a forest such as a wind storm or fire, some species are crucial to the recovery process, but these same species may play little role in a mature forest. Any given species will appear to be essential or redundant, depending on the ecosystem, scale, perspective, and reorganisational state in which it is found. It is not a matter of “either/or”, but “when” species play which functional roles.[11]

Species represent merely one aspect of biodiversity. A focus on them provides an insufficient basis for effective conservation policy. After all, we don’t even know the total number of species on earth, and this makes it difficult, if not impossible, to determine how much biodiversity loss has occurred, whether as a result of human activities, or natural processes.[12] Instead of focusing narrowly on species, we should strengthen biodiversity policy by embracing a wider, more complex view-- one which encompasses the many roles of biodiversity in ecosystems, at all scales and perspectives, and according to overall system function. In this way, biodiversity conservation may be more tightly linked with our new understanding of ecosystems.

The Problem of Stability

It has long been assumed that there is an inherent "balance" or stability, in nature, which biodiversity helps to maintain. This, it has been suggested, is a strong argument for conserving biodiversity.[13] Many policies have been based, at least in part, on this assumption (for example, protected areas and parks management plans). However, this notion of stability is difficult to defend in scientific terms.[14] Merely defining what is meant by "stability" is difficult -- living systems experience many fluctuations, such as in the weather, populations, biomass and so on.[15] The lack of a single, accepted definition for stability is also confusing and frustrating for policy makers and planners

More recent ecological ideas, based in part on complex systems science, provide a revised perspective of living systems, in which the idea of a single “stable” state is replaced with that of a “shifting steady state mosaic”. In a forest, for example, there are different patches of forest, each of which is a different age. Each patch will grow to maturity and then fire, windstorm, pest outbreak or some other disturbance will cause the trees in the patch to fall over and growth to start again. This process goes on in each patch on the landscape, so that at any given moment some part of the landscape will be at any specific age. Which pieces are at which age changes with time. Hence the patchwork mosaic is shifting constantly over the landscape, even though the landscape remains a forest.[16]

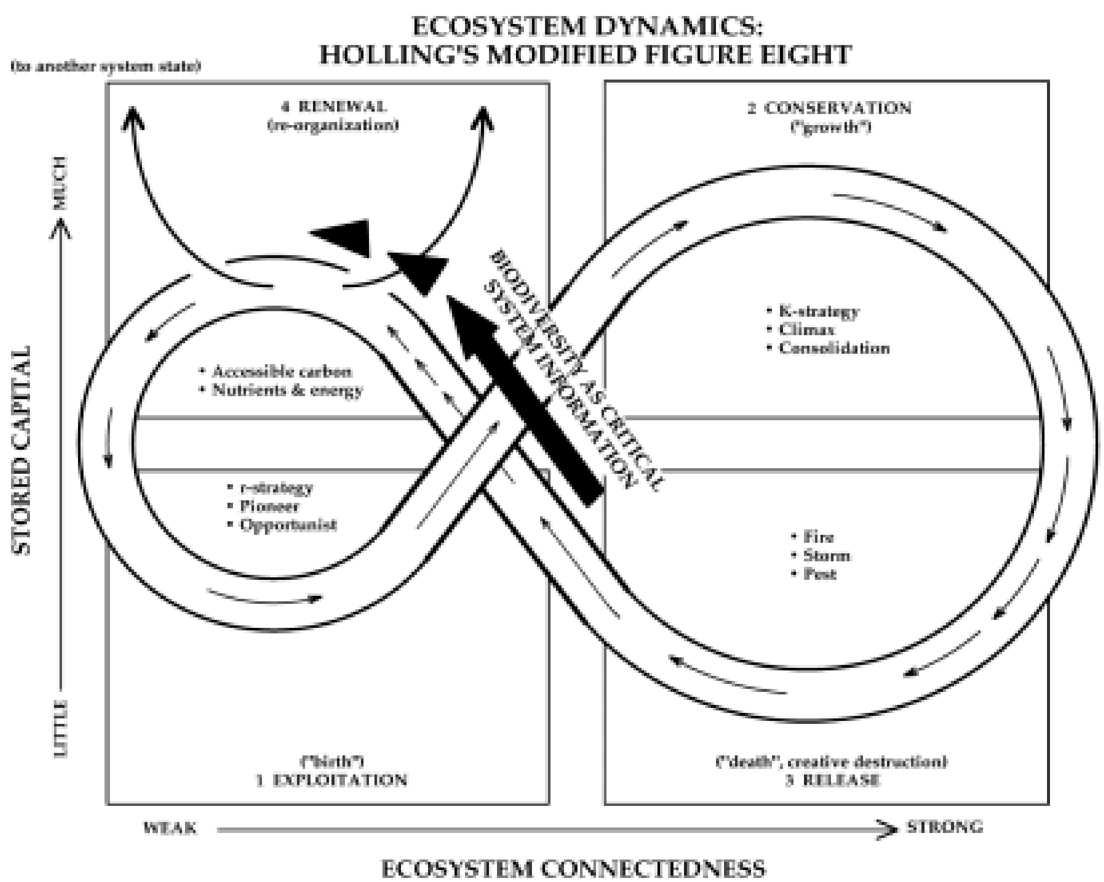
Ecosystems actually have multiple possible operating states, and may shift or diverge suddenly from any one of them. For example, in the Huron Natural Area case study, considered later in this chapter, part of the natural area is a closed soft maple swamp in a wetland community. However, changing flows of water can radically alter this state. Drying events such as an extended drought could change it to an upland forest community or grassland. If, in contrast, extended periods of flooding cause high water levels, it would become a marsh ecosystem. Red and silver maple will tolerate floods lasting as long as 30% to 40% of the growing season. Longer than this, and the trees will die, giving way to more water tolerant herbaceous marsh vegetation. The feedback mechanism which maintains the swamp state is evapotranspiration (i.e. water pumping) by the trees. Too much water overwhelms the pumping capability of the trees and not enough shuts it down. The point is that the current state of the ecosystem is a function of its physical enviroment and the accidents of its history. Each of these three ecosystem states is as ecologically healthy and appropriate as the others. There is no one "right" community for this landscape.

Ecosystems may even literally flip into a new state. These flips have been identified in the Great Lakes, where the dominant ecosystem moves from a benthic to a pelagic state quite suddenly. Change in an ecosystem as a result of natural catastrophe, such as fire, pest outbreak or human-induced perturbation, is a normal and usually cyclic event.[17] The implication is that the ability of ecosystems to recover, reorganise and adapt in the face of regular change, rather than stability, is critical to their survival.

It is in this context that biodiversity is vital to ecosystems: biodiversity is the basis of resilience: that is, the ability of an ecosystem to buffer itself from being pushed into another state, and also its ability to regenerate itself following a shift or other disturbance. Biodiversity could be considered as analogous to a library of information (some recorded long ago, and some only now being written), that provides not only a wide range of possible pathways for the future development of life, but the library of learned repertoires for responding to environmental change and disturbance.[18]

Figure 1 depicts a modified version of Holling's dynamic cycle of ecosystem development. Living systems evolve discontinuously and intermittently. Following a sudden disturbance, an ecosystem reorganises to "renew" itself or regenerate to a similar or perhaps different state. Immediately after a disturbance, biodiversity at many scales is critical: the abundance, distribution, and diversity of an ecosystem's structures (e.g. species) and functions (e.g. nutrient cycling) determine its ability to regenerate and reorganise itself, and its future pathway.

FIGURE 1: Ecosystem Dynamics



Biodiversity is vital to the normal, healthy functioning of ecosystems because the information it contains and the functions it serves constitute the key elements that determine how an ecosystem will self-organize. In effect, biodiversity forms the palette of future possibilities for an ecosystem.[19] The notion of biodiversity as an essential basis for ecosystem resilience therefore provides a more powerful premise for conservation policy than does stability, and ultimately, a more robust basis for conservation plans.

Learning By Doing

This view of ecosystems as open, dynamic, complex, and uncertain (i.e. inherently unpredictable) has significant implications for conservation. We can never determine with precision the consequences of our actions. In effect, "environmental management" is an oxymoron, because we can never truly “manage” living systems.[20] But what we can do is re-focus our energies on those human activities which provide the context for the self-organising processes in ecosystems.[21] This implies a profound change in environmental planning and management.

If uncertainty and regular change are inevitable, then we must learn to be flexible and adaptible.[22] But what does this mean in practice? Recalling the importance of multiple perspectives at various ecosystem scales, one of the first steps towards flexible adaptive planning is to use a diversity of approaches to conservation. This means emphasizing the small-scale, the experimental, and the action-oriented. Ecosystems may change in any number of possible ways, and so there may be an infinite number of possibilities for conservation. “Good” conservation planning then, requires a diversity of tools, techniques and methods.[23] Learning becomes a central goal, leading, ideally, to continual improvement in planning and management -- in effect, to adaptation.

In conservation, we should consider demonstration projects that emphasise “learning-by-doing”.[24] Such projects should be small enough that if they are not successful, they can fail safely, without endangering an entire ecosystem, watershed or habitat. “Failures” or mistakes may provide experience that can be used in the future. In this way, the “surprising” nature of ecosystems can be turned into a learning opportunity rather than a liability. As Kai Lee observes, “experiments often bring surprises, but if resource management is recognised to be inherently uncertain, the surprises become opportunities to learn rather than failures to predict”.[25]

Of course, conservation policies and plans must still be rooted in science, drawing on new knowledge in conservation biology, ecosystem and landscape ecology.[26] But adaptive planning must also proceed on a broader scale, linked to experience as well as to research. Learning through experimentation and action also requires field-trained specialists, and more expertise and research in systematics and taxonomy -- neither of which can now be provided by Canadian universities. Conservationists and ecologists agree that conservation management and research needs more "boots not suits", and a stronger connection between knowledge and action.

But there are significant barriers to learning through action. Planners and managers are usually not rewarded for perceived failure, no matter what lessons were learned. Being open, flexible and adaptive to change is often discouraged.[27] We need instead to reward learning, so that decision-makers will be encouraged to experiment, to collaborate in sharing results, to learn from experience, and overall, to be responsive to change.[28] Rewarding, rather than punishing, mistakes, can help link knowledge and action. Trial and error is, after all, one way that humans learn.

"Learning by doing" means profound changes to our tradition of planning and management. It is still widely assumed that with enough research and knowledge, nature can be predicted, and therefore controlled. But as discussed here, new insights from ecosystem ecology and complex systems theory have shown that this is not how the "real world" really works. If ecosystems are indeed dynamic, diverse, open to surprise and sudden change, then nature is not under our control. Adaptation and flexibility becomes essential. We must learn to live with nature. We must learn to look to multiple perspectives and values, at different scales and in different contexts if we wish to truly manage our interactions within nature.

Integrating Science & Values: Beyond Prescriptive Planning

Sustainable development is about making choices, in the light of the limits to growth and the need for equity. As an integral component of sustainable development, biodiversity conservation incorporates aspects of both science and politics. Ecological realities can be determined to some extent through scientific inquiry and learned experience. But in a complex world, this knowledge illuminates not "solutions" but choices and trade-offs, the selection of which is driven by values.

However, decision making for biodiversity today relies largely on science to determine these choices, and rarely considers values explicitly. While it is widely acknowledged that biodiversity embraces a vibrant suite of social, economic and spiritual, as well as non-human biocentric values, we do not yet make real use of this rich texture of meanings in our conservation policies and plans.

The dominant reason for this is that much of institutionalised planning is rooted in a "scientistic" tradition known as the "rational-comprehensive approach". This approach is modelled on the scientific method and advocates objective decision-making. Planning is seen as a top-down, expert-driven, rational activity, relying on management through control.[29] But as we know through ecosystem research, biodiversity cannot be managed through prediction and control. In addition, in its social, cultural, economic and political dimensions, biodiversity is very much about values, and this must be reflected in its management and conservation. The domains of science and values must therefore be integrated within conservation.

One way to begin integrating values into planning is through the use of visioning. Visioning is a planning tool, one of several now being used to generate consensus through shared perceptions of a desirable future.[30] It may also be a useful tool for integrating biodiversity values into conservation planning. Adaptive planning, that integrates values and science (through visioning or another collaborative forum), is essentially a design process, through which we collectively evaluate and decide which of many futures we wish to steer ourselves towards, through choices, trade-offs, trial and error, learning by doing, and flexible management.

The HNA Case Study

The Huron Natural Area (HNA), in Kitchener, Ontario, provides a useful case study of adaptive planning and management for conservation.[31] Like much of southwestern Ontario, the Kitchener area has undergone extensive urbanisation. This has resulted in a fragmented, patchwork landscape. Much of the Kitchener area is comprised of upland, maple-beech (Acer spp. and Fagus spp.) forest remnants.

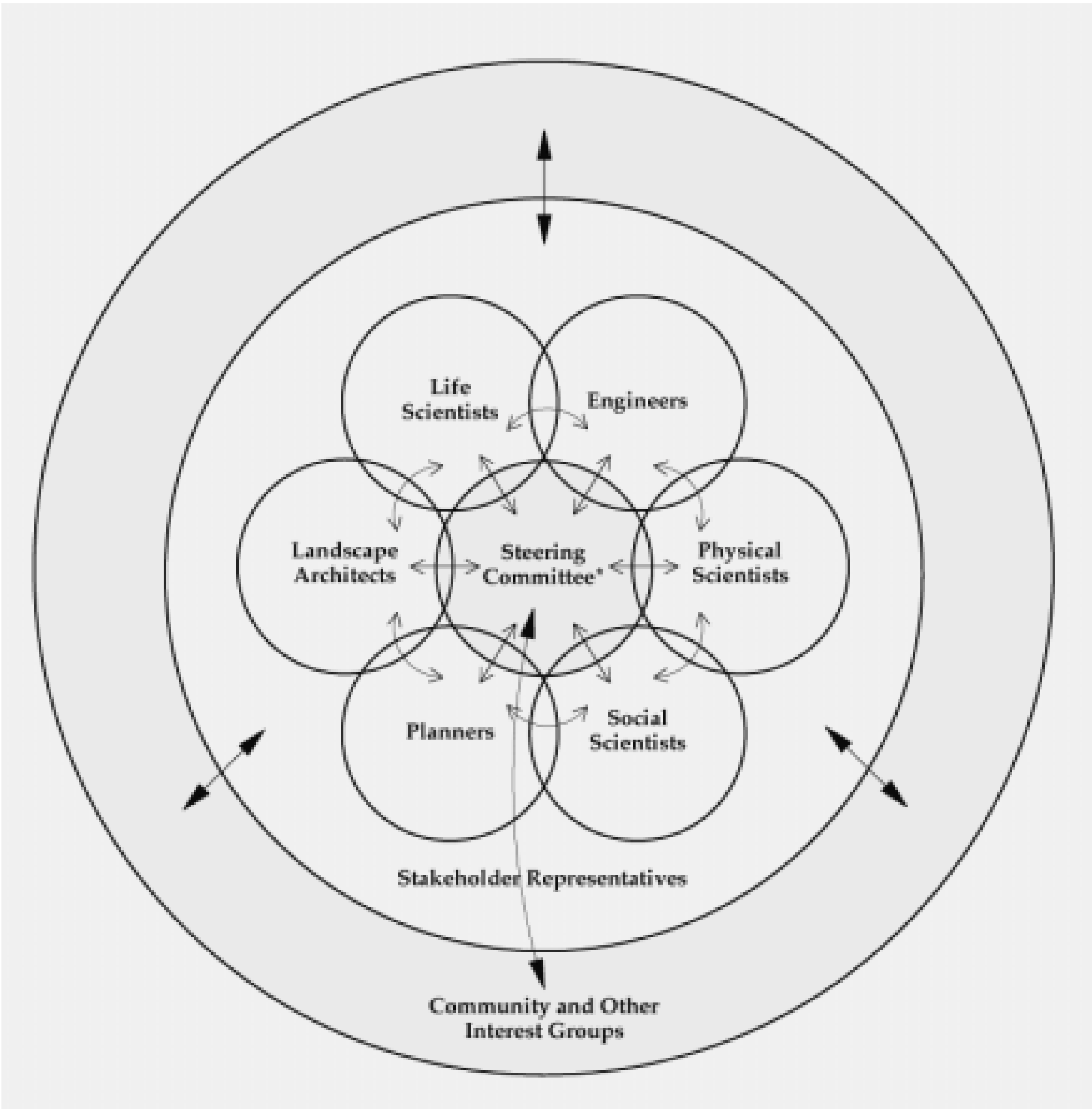
The Huron Natural Area is about 150 hectares within the City of Kitchener, bounded by major roadways and a business park. Strasburg Creek, a cold water stream supporting a population of brook trout (Salvelinus fontinalis), flows through the site. A Provincially-designated Class I wetland known as the Central Wetlands forms the eastern boundary of the area. The HNA is part of the Grand River Watershed which, in turn, drains into Lake Erie. It was originally settled, and much of it cleared and farmed in the late eighteenth and early nineteenth centuries. In the post-war years, much of the land was taken out of agricultural production and converted to industrial and residential uses. The site itself was largely abandoned during this period, although some restoration work, in the form of plantations and wetlands, was done during the 1940s. It had been considered for development of a suburban, commercial business park, but during the planning process its ecological diversity and potential as a park became evident.

The site contains a variety of ecological features including pine plantations (Pinus resinosa and Pinus strobus), mature maple-beech forests (Acer saccharum and Fagus grandifolia dominating), old farm fields, ponds, a dry marsh, varied topography, and ground water recharge areas critical to Strasburg Creek. There are 14 different vegetation zones with 276 plant species, as well as a variety of glacial landforms. Overall, these features indicate an opportunity to retain an important example of the diverse landscape which once characterised much of southwestern Ontario. As a result, the City of Kitchener, in co-operation with local school boards, made a commitment in 1991 to preserve this area.

During the early 1990s, consultants identified the area's conservation and educational potential, university researchers examined its ecological processes, and the area was re-zoned. The HNA was also incorporated with a Board of Directors, and a formal partnership agreement was signed between the City and the two school boards. Adjacent land identified as essential to the integrity of the HNA is now being acquired. In 1995 a Master Planning Committee was struck, and collaborative planning began. **Figure 2** provides an example of a planning model being followed by the HNA Master Planning Committee. The team is essentially a partnership, with representatives from each relevant profession, science, and community interest. The

Master Plan is being generated through collaboration between the team, the clients (Board of Directors), and the community of users.

FIGURE 2: A Master Planning Team: Synergy Through Collaboration



The goal of the HNA Project was derived from the vision statements of participants at a Visioning Workshop held in 1995. The participants included representatives of the Steering, Citizens', Technical, and Master Planning Committees. A Citizens' Advisory Committee was also established to assist with stewardship initiatives and implementing the plan.[32] The goal can be encapsulated in the following stakeholders' statement:

"Using our definition of ecological integrity,[33] we want to develop an ecosystem-based management approach and complementary monitoring program which allow us to use the site sustainably while maintaining the valued ecosystem features."

Within the context of this goal, there are three key objectives:

1. To promote an awareness of natural ecosystems as functioning, dynamic entities;
2. To improve links between ecosystem science and municipal land management decision-making within the Region of Kitchener-Waterloo; and
3. To use the information gathered through the monitoring program to inform the planning and management process on a continuing basis.

These objectives will be promoted through a series of demonstration projects within the HNA, as well as conservation and educational activities at local schools and universities.

A variety of studies have been undertaken over the past seven years on the ecosystem's abiotic, biotic, cultural and energetic features.[34] The abiotic features include climate and hydrology; biotic features include wildlife communities as well as individual species and populations; cultural features include human use of the area, and its cultural and heritage value; and ecosystem energetics include flows of energy and nutrients. These principles have been examined at a variety of scales, ranging from the Strasburg Creek sub-watershed to the Great Lakes Basin. Next steps will include ecological study, and results of preliminary monitoring data will be used to construct possible future ecosystem scenarios, which will be used to identify planning options, with the guidance of stakeholders and community participants.

At present, ecological study indicates two possible ecosystem states which now co-exist, but are not likely to persist. The first supports a slow-moving, low-oxygen, warm-water stream interrupted by ponds and small wetlands, in which beaver (Castor canadensis) and muskrat (Ondatra zibethicus) shape and maintain the habitat and its communities. Several factors are shifting the ecosystem towards this state: the resident population of beaver, invading Purple Loosestrife (Lythrum salicaria), and nutrient-rich runoff from nearby agricultural areas which depletes oxygen in the stream. The competing state is a fast-moving, highly oxygenated cold-water stream, in which brook trout thrive. The latter state is perceived to be highly desirable, but would likely require intensive management to maintain.

In setting their goal and objectives for the area, the stakeholders have indicated a desire to protect a wide range of biodiversity, including both brook trout in the Creek and the beaver ponds. But this may not be feasible, as the two populations belong to potentially mutually exclusive ecosystem states. A difficult choice may therefore have to be made, in favour of one population over the other. In making this choice, the values of stakeholders and community members will play an essential role. This exemplifies the role of value judgements in making choices, for example, beaver versus trout.[35]

Clearly, developing a conservation management plan must be an iterative process, wherein information gained through ecological research and modeling feed into the planning process, and the results from this process feed back into model and scenario development, or perhaps into new goals based on changing values. This process continues until an acceptable ecosystem function and performance is observed. Ideally, the adaptive planning process will be used over the long-term, as the management of the HNA is continuously adapted to changing ecological, social and economic conditions. Thus, the Huron Natural Area Project is a unique example of holistic, learning-based adaptive planning and management -- truly, a process of "designing within nature".

Practising Resilience: Diversity in the Planner's Toolbox

Decisions today are usually based on particular sectors, such as agriculture, fisheries, or finance, rather than the interdisciplinary issues affected by these sectors, such as changes in habitat, resource depletion, or poverty.[36] A tendency to reduce, simplify and control natural systems often accompanies this approach. Our institutions are not, by definition, designed to be flexible, adaptive, resilient or accommodating of change through learning: rather, they are designed to resist change through rigid, top-down structures based on a hierarchy of expertise.

This phenomenon is perhaps best expressed by the disjuncture between politics and ecology. Political boundaries (e.g. municipal/regional jurisdictions) are a major obstacle to dealing with ecological phenomena, including biodiversity, that cross these boundaries. And political decisions, which tend to fragment, manipulate and control natural systems, and which nearly always impose a single ecosystem perspective, have also led to the homogenisation of landscapes and, ultimately, the loss of biodiversity.[37] The consequences of this are that the ability to self-renew and regenerate complexity is diminished, and eventually lost. The result is a paradox: control-oriented management of biodiversity will reduce diversity.[38] This indicates an urgent need to create institutions and processes that engender diversity, and a plurality of perspectives, both in society and in nature.

In moving toward adaptive rather than control-oriented management, decision makers must focus on ecosystem processes and resilience. There are three general criteria in planning for resilience: 1. in the absence of certainty and given the realities of ecological trade-offs, more voices, values, perspectives, and forms of knowledge must be drawn on to support responsible decision-making; 2. in the presence of complexity, collaborative processes are essential to better decisions (by including multiple perspectives, the lessons of history, and so on); and 3. changing conditions and a variety of possible solutions require more innovative and diverse planning tools and methods. Each of these criteria is being addressed in the Huron Natural Area, and is elaborated on in the following sections.

Redefining Expert Culture
Uncertainty is inevitable in ecosystems, and making predictions on the basis of mechanistic casual models is not possible. In addition, in any given circumstance there is more than one possible state for the ecosystem. These states represent different solutions to the problem of survival in a given environment. Thus there is no single ecologically "right" state for an ecosystem.[39] This realization, coupled with the inevitability of uncertainty, means that we can no longer rely on “experts” who know the “right answers”. The alternative is to open decisions to a greater variety of players, disciplines and voices, and their diversity of values, experiences and perspectives.

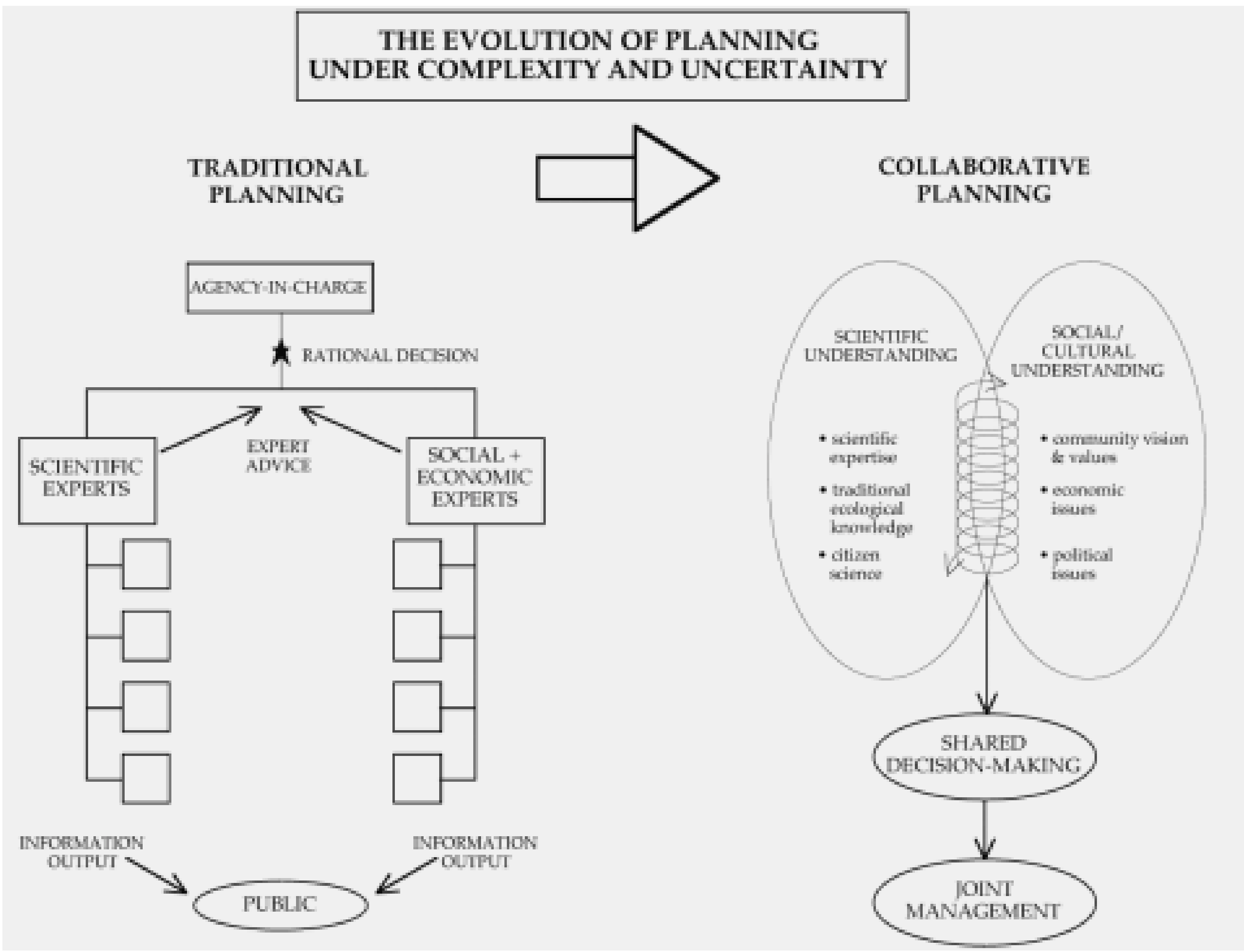
Decision-making for conservation must become a co-operative endeavour that relies on shared learning through action. Many scientific disciplines, ecosystem perspectives, and related types of knowledge must therefore contribute to the information used in decisions. Because neither social values nor conventional science alone can adequately describe ecosystems or biodiversity, a co-operative, interdisciplinary approach to research as well as practice is essential.[40] In the HNA, this approach was undertaken through a shared visioning exercise, in which scientific experts, community leaders, ordinary citizens, and school children participated. Their involvement continues today through various committees, input into the Master Plan, the education system, and local stewardship initiatives.

The challenge, however, should not be underestimated. Our planning and decision-making structures are not designed for either co-operation or learning. Ours is a culture of experts, not usually questioned by those outside the discipline. In contrast, a more participatory and co-operative decision-making model demands much sharing, questioning and humility, as learning through action is not prescriptive, involves trial and error, and critical thinking.[41]

Such a model would benefit from the “democratisation of science” in which the pursuit of quality decision-making (rather than a single solution or “Truth”) is the goal.[42] This is particularly applicable to dynamic, complex, uncertain, urgent conditions, as often encountered in efforts to protect biodiversity. Quality decision-making may be achieved by extending the conventional expert culture to include other voices and values as legitimate knowledge, such as the traditional ecological knowledge (“TEK”) of indigenous cultures, landowners, lay naturalists, and cultural historians.[43] In doing so, a role for deeper participation, and eventual collaboration in planning and decision-making is validated, and a more flexible approach to making decisions can emerge. This perspective can also be extended to research, in determining which disciplines and other forms of knowledge are ultimately used to support a value-driven planning process.

Figure 3 depicts how decision-making must change to deal adequately with complexity and uncertainty. On the left, a generalised sector-based and top-down structure is shown, in which a hierarchy of experts supplies information in relative isolation, i.e., separated by discipline. On the right, a more flexible and organic model is offered, in which many forms of knowledge and values - including conventional science as well as citizen science, traditional ecological knowledge, and economic, political, and cultural values - are integrated into a collaborative, shared decision-making process. A collaborative model ideally incorporates both top-down (expert) and bottom-up (citizen or grass-roots) approaches, as managers, planners and field-personnel must work iteratively to share knowledge.[44] Furthermore, citizen and community participants must possess a certain degree of scientific understanding and ecological literacy to contribute effectively.[45] This is also considered an important criterion of membership on the HNA Citizens' Advisory Committee, and can ultimately lead to improved education and stewardship by the wider community.

FIGURE 3: The Evolution of Planning Under Complexity and Uncertainty



Collaboration in Planning

Collaboration creates new possibilities, by breaking barriers and forging new paths. In this process, creative partnerships may be formed between stakeholders or various interest groups which encourage the integration of ecological, economic and social values with science for biodiversity. Through sometimes unconventional alliances, we can build new and exciting alternatives to the adversity and conflict that too often force us to choose convention over innovation. In the HNA, for example, cooperation between the public and separate school boards, and the municipal government set a precedent for breaking jurisdictional boundaries and creating a new business partnership.

Collaboration implies equity among participants in the planning process, and therefore, empowerment of different voices, opinions, values and sources of information. The adaptive framework advocated here is based on interdisciplinary collaboration, feedback, and learning, by an integrated team of professionals from a wide range of disciplines, as well as community representatives and citizens working together towards a holistic conservation plan, with support by a Technical Advisory Committee and a Citizens' Advisory Committee). While it is true that collaborative planning can be time-consuming, there are also clear benefits.

In a collaborative process such as the HNA Master Planning exercise, all issues and values are on the table from the start. This reduces miscommunication, and enhances the potential for integrated, joint management. While collaboration usually takes longer, it is cost-effective in the long term, as it usually results in a single best planning solution that fulfils participants' goals and objectives without the need for several alternative plans. It should also not be overlooked that long-term community stewardship is a critical additional benefit -- and this was a central goal of the HNA collaborative process.

Common sense, and experience, suggests that less fragmentation and more integration in decision-making results in a more holistic, relevant, and socially-acceptable plan. However, there are several challenges involved in more open, flexible processes of decision-making. Planners and managers need to concern themselves with issues of empowerment, ethics, literacy, commitment, and timing.

Collaboration is critical in setting goals, through visioning, identifying values, and combining these with scientific information, as occurred in the HNA planning process, beginning with the Visioning workshop. However, the conservation community will need to be vigilant to ensure that no single interest co-opts another, or that no special interest dominates. In conventional "citizen participation", in contrast, one powerful interest often permits only limited input from others (usually non-experts). A collaborative process differs in that decision-making power is distributed equally around the table, or at least is allocated by consensus when the process is being designed.[46]

It is also important that a full range of values for biodiversity be kept central to the planning process. This is critical to success because planning goals must reflect socially as well as ecologically desirable scenarios. Only by explicitly recognizing them can all values be validated and considered by participants, and potential conflicts be resolved.

It is also vital that participants in a collaborative process have a basic knowledge of the relevant science and policies, as well as an awareness of how collaboration works. Without a general willingness to learn, such a process may do more harm than good, particularly if one special interest or set of values dominates. Similarly, "experts" or technical information providers need to understand the collaborative process; they must understand that non-expert values are legitimate and must be considered before a plan can be implemented - even if these values are contradictory. This issue sometimes arose within the HNA process.

Participation in a collaborative planning process must also require a commitment to the process. There should be no "free entry" for late comers who seek to shut down or stall a process which has been open and transparent. Conservation is more likely to succeed if members buy into the process they develop and feel a sense of ownership in it. Rules for participation and criteria for commitment can be determined by consensus at the outset.

Finally, there are strategic points for collaboration with the wider community in any planning process (see e.g. Figure 4). In the early stages, an interactive ideas workshop might be held, through which a vision and project goals and objectives can be developed, as was done in the HNA project. From these and through feedback with the community, planning criteria can be established. The conservation plan and associated management strategy can be generated within a planning workshop or charette in which community members participate with a master plan team. This should also be an interactive event, in which poster displays, building blocks, 3-D computer modelling and other tactile and visual media can be used to help the community visualise and "feel" the expected results of various planning options. As the plan is further developed, the community may continue to provide feedback at key points, and eventually, participate in monitoring and performance evaluation.

Ideally, all interested and capable parties should collaborate in shaping a conservation plan. However, this will only make a meaningful difference if this collaboration begins at the outset of the process. In our experience, collaboration in defining the vision, the goals, and the plan itself almost always results in a sense of stewardship by participants. This means harnessing the dedicated energies of the wider community through formal involvement in conservation decision-making.[47] In the HNA project, for example, core members have remained committed and involved in the planning process for two years, and some for as long as six years.

Innovation in Strategies

While conservation advocates generally agree that biodiversity protection is in the public interest, and so should be a public responsibility, it would be problematic to continue to reply on the public-sector system of protected areas as the principal strategy of conservation, particularly in an era of government cut-backs and diminished political will. In moving towards more flexible and resilient planning for conservation, we need to look to a more diverse range of methods and tools, including those offered through collaborative planning

Our national parks system is admirable, but is in economic and ecological trouble. There has been a dramatic decrease in funding for creating, maintaining and operating parks, and there is little political or economic motivation to set aside more large tracts of land.[48] At the same time, provincial parks systems and virtually all publicly-funded protected areas, as well as related scientific research, have been affected by budget cuts. Several key biodiversity-related activities continue to decline: the federal government's interdisciplinary Tri-Council "Eco-Research" program was terminated in 1997; budgets of major museums for natural history collections are shrinking; there are few jobs for field-trained conservation biologists and ecologists; and University-level systematics and taxonomy courses have also declined, resulting in few new, trained field experts.

Our national parks and other protected areas protect only between 5.9% and 7.1% of Canada's land area. Clearly, other strategies need to be explored if Canada is to reach the target of 12% protection. Fortunately, there has been considerable recent work in Canada on innovative planning strategies and associated tools for conservation. Promising conservation strategies include partnerships with the private sector; private protected areas; community-based land trusts; the use of creative zoning; and shared conservation through municipal and regional Official Plans, which make use of adjacent, established protected areas. The HNA is a prime example of a public-private partnership for conservation. Similarly, Georgian Bay Islands National Park has established a network of conservation supporters and advocates outside its official boundaries, but within its greater ecosystem. Through the use of a "vision map," park officials, in consultation with community groups, local planners and landowners, have created a conceptual plan that identifies core ecological areas of interest and connecting corridors throughout the greater park ecosystem -- many of which are on private or municipal lands, yet may nevertheless offer conservation potential through local land trusts, as stewardship areas, or protection by municipalities.[49]

Southwestern Ontario, known as the Carolinian bioregion, is an area rich with examples of alternative conservation planning strategies. A fragmented landscape, and the unlikelihood of scattered natural areas ever being integrated together, has forced conservation planning to rely on cooperation. For example, in 1984 the Natural Heritage League, in conjunction with the World Wildlife Fund, began a landowner contact program, that led to creation of a private stewardship program.[50] Participation is voluntary and success in adding lands under conservation depends on co-operation by public and private landowners. While traditional planning tools are also used, including regulation and legislation, the distinctive feature of conservation is co-operation between regulated planning strategies and non-regulatory or voluntary strategies. Information on biodiversity is also collected and shared among various agencies and citizen action groups. Overall, such strategies serve to illustrate the potential of an integrative and collaborative framework for planning.

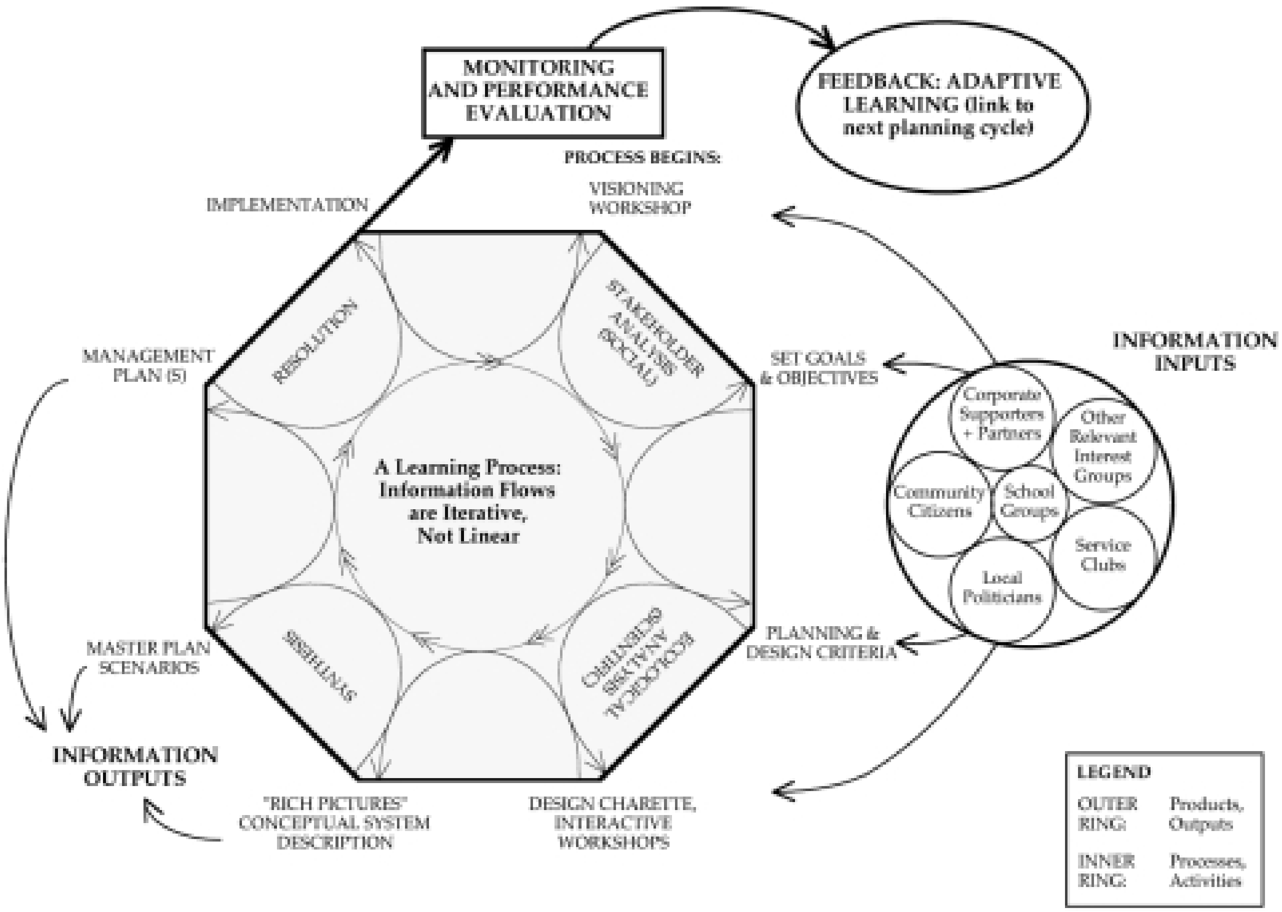
Towards Adaptive Planning In Practice

This chapter has established the need for an adaptive approach to conservation planning that integrates values, science and policy into a decision-making framework in a rigorous and defensible way. Here, "rigour" means quality through an open, transparent, accountable, and collaborative process in which values for biodiversity are made explicit, and learned experience is fed-back through regular plan reviews into on-going management. While the adaptive management concept appeared in the ecological literature in the late 1970s, and has been evolving slowly ever since, only within the last few years has it begun to move from theory to practice.

Recently, scholars and practitioners have begun to synthesise the notions of complexity and uncertainty in ecosystems with ideas of how organizations can adapt to change. Biodiversity conservation is an ideal domain in which to play out this synthesis, because it highlights the mismatch between ecosystems and the decision-making structures through which we attempt to plan and manage them. The challenge is to reform decision making, from control-oriented, predictive and interventionist management of the environment, to adaptive, flexible and participatory management of human activities. In these ways, adaptive planning is a process that more closely models the living systems it is intended to shape, and that is responsive to change in these systems, responding to new ecological information before critical and irreversible thresholds are crossed. In this way, adaptive management is "to learn to manage by change rather than merely reacting to it".[51]

Figure 4 depicts an adaptive planning process, and reflects the general approach undertaken in the HNA project. Planning in an adaptive context is cyclic and continuous, and learning is a conscious activity, derived from information as it is acquired, which in turn is transformed into knowledge through adapted behaviour in the next planning cycle.[52] Although the planning process can begin anywhere, the "ideal" process begins with visioning (identifying "what is desirable"). The process proceeds with setting planning goals, objectives and targets, planning criteria, and interactive workshops or a design charette (in combination with ecological research, identifying "what is possible"). The process results in several forms of synthesised information, including conceptual models of how the local ecosystem works and how it relates to the broader social context; a master plan; and a management strategy. From this, the plan should be refined, implemented and monitored, with lessons from experience being used to begin another planning cycle.

FIGURE 4: An Adaptive Planning Process



Conclusion

Conservation planning is in transition. At present, it is fraught with complexity and uncertainty -- from the science it relies on, to the range of policy options and planning tools available, to the plurality of perspectives and diversity of voices needed. Conservation planning must become a more flexible, resilient and adaptive process, based on proactive, collaborative learning, and rooted in an interdisciplinary (and perhaps even transdisciplinary) art and science. In doing so, we engage in what is ultimately a process of design.

In moving towards more adaptive decision-making, we may navigate the murky waters of uncertainty and complexity that are the hallmarks of our living environment. A new era is possible: in which we value and celebrate the diversity of life, that while it confounds and frustrates, also inspires and motivates the human spirit. This is a paradox of life to be embraced by the challenge of doing adaptive planning, and therefore, designing within nature.

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