Slocan Group
Quesnel Division

Adaptive Management:
A Framework to Support Sustainable Forest Management

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Executive Summary

In the fall of 2003, Slocan Forest Products initiated a project to explore what would be required to utilize adaptive management (AM) as a foundation for Sustainable Forest Management (SFM). AM is the process by which a commitment to learning is used to adjust management strategies so as to better cope with change while simultaneously seeking to better understand how management goals can be achieved.

An AM approach recognizes change as a constant factor so it is necessary to understand the root causes of what has, and may be changing. To do so requires learning how the economic, social and ecological systems are constantly moving through a cycle that involves change and reconfigurations in response to human attempts to manage them. If the system is resilient, then it can absorb a degree of change without a major reconfiguration. However, if the system is rigid and lacking resiliency, then change may result in a crisis that causes the system to flip to a different stability plane. For example, when one mill is closed in order for a company to reconfigure its operations to remain viable as an entity. Thus the first step is to understand the current state of the systems in terms of their existing resiliency. A desired concept of resiliency is then defined for each system, including an acceptable range of variation. This does not preclude society choosing to undergo a major reconfiguration, or that such a significant change is required in order to get the system to a point where it can be resilient. The concept of resiliency is then used to socially define sustainability across the three systems through an iterative process that considers trade-offs in terms of impacts to system resiliency within selected spatial and temporal scales.

The desired concept of sustainability is described through management goals and objectives, with the associated uncertainties and risks translated into learning objectives. Various learning strategies are then assessed to determine the best vehicle to test management practices. A structured monitoring process is used to generate results, which are then evaluated in terms of their validity, relevance and significance. Through the evaluation process, monitoring information is combined with values, experience, training and intuitive thinking in order to achieve shared knowledge and derive meaning that is useful in developing recommendations for adaptations to management practices, the overall plan, etc.

To be successful, AM also requires decision-makers to acknowledge that uncertainty is a given. Therefore, SFM plans need to recognize that reality and work within it, rather than planning to eliminate uncertainty. This has implications for not only how the problems are defined, but also the mandate given to those who are responsible for addressing the problems. A review of literature identified a high degree of failure for AM applications, partly due to AM being used for specific projects in absence of building the necessary adaptive culture within key institutions. As a result, a comprehensive AM approach has been developed to address the needs of a corporate forest company in relation to SFM. The resultant AM framework consists of:

- Corporate level strategies for developing and maintaining the necessary corporate culture to support effective use of AM;

- Program level approaches for incorporating AM principles into strategic, tactical and operational planning processes to create the necessary context for successful use of AM at the project-level. For example, the mobilizing force for implementing SFM policies, and;

- Project level assessment of opportunities/benefits/costs for utilizing various AM approaches on a project-by-project basis.

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1. Introduction

This report represents one aspect of Slocan Forest Products' efforts to develop a Sustainable Forest Management (SFM) framework. In the fall of 2003, Slocan initiated a project to explore what would be required to utilize adaptive management (AM) as a foundation for SFM. A review of literature resulted in few specific references to the roles, responsibilities or perspectives of corporate interests in utilizing AM, nor the institutional requirements (i.e. support systems) that might be specific to such interests. As a result, this project has been used to develop a comprehensive AM approach that would be specific to the needs of a corporate forest company in relation to SFM. The resultant AM framework consists of:

- Corporate level strategies for developing and maintaining the necessary corporate culture to support effective use of AM;
- Program level approaches for incorporating AM principles into strategic, tactical and operational planning processes to create the necessary context for successful use of AM at the project-level. For example, the mobilizing force for implementing SFM policies, and;
- Project level assessment of opportunities/benefits/costs for utilizing various AM approaches on a project-by-project basis.

The corporate strategies are outlined in section 7: Implications for a Select Corporate Forestry Context. An overview of the program and project level aspects of the framework is also discussed in section 7. However, the program and project level aspects are addressed in more detail in a compendium to this report entitled *Adaptive Management: A Guide for using Adaptive Management within the context of Sustainable Forest Management* (Scott-May and Field 2004). While this report defines the context for the AM Guide, the latter has been developed as a stand-alone document. As a result, key AM definitions and concepts discussed in this report are also included in the AM Guide.

2. Methodology

The project was initiated by conducting a literature review and telephone interviews of AM experts to help define the scope of the project. The literature review was conducted with a particular focus on:
- defining AM within the context of SFM;
- identifying barriers to successful utilization of AM;
- support systems and strategies for overcoming the barriers, and;
- use by, and associated issues for, corporate forest interests.

Brian Nyberg, Manager, Range and Integrated Resources Section, Ministry of Forest, and his staff developed a database and library on AM. The database was reviewed and materials selected that related to the above aspects of AM. The interviews of AM experts were also used to identify additional source materials and people to interview in subsequent stages of the project.

The initial literature review and interviews of experts resulted in the report, *Development of an Adaptive Management Framework: Summary of Literature Review* (Scott-May et al. 2003). The summary highlighted the issues raised in case studies and AM theories that need to be addressed in the development of an AM framework for use by a corporate forest company. The key outcomes of the literature review are included in this report in sections 3: Defining Adaptive Management and 4: Theories and Realities.

An initial draft AM framework was then developed based on the literature review. In order to assess the initial draft, it was considered relative to a current issue of significance to corporate forest interests. The intent was to get feedback from front-line corporate staff who might eventually use the AM framework. It seemed likely that such staff would be more interested, and could more effectively participate, in discussing AM within the context of a current concern, rather than a conceptual AM framework.   Ecological representation was selected as the test case issue because:

- it is key to meeting the biological richness criterion within Slocan's SFM framework;
- it reflects the current complexity of SFM, namely it includes scientific, technical, legal, policy, funding, social and economic aspects, and;
- relatively good information exists.

The workshop on representation was held on December 1 and 2, 2003 in Cranbrook, B.C. Participants included representatives of Slocan's Radium and Slocan Divisions, Tembec, the Ministries of Forests, Sustainable Resource Management and Water, Land and Air Protection in addition to Parks Canada.

As a result of the representation workshop, gaps in the AM framework were identified. Informal telephone interviews with AM experts were undertaken in order to address the gaps and probe key barriers and identified issues. Given the focus on how AM might be used by a corporate forest company, representatives from such organizations were one particular focus of the interviews. This included a focused workshop In January 2004 with staff at Slocan's Ft. Nelson Division. Additionally, given that Weyerhauser BC Coastal Group was consistently identified as a leader in AM, a face-to-face interview was conducted in February 2004 in Nanaimo, BC. The key lessons learned from the workshop on representation and interviews with AM experts associated with corporate forest interests are summarized in section 5: Adaptive Management within a Corporate Forestry Context: Select Perspectives.

The insights gained through the initial literature review, representation workshop and subsequent interviews with AM experts were then used to develop the overall AM framework. In February 2004, a workshop was held in Vancouver with staff from all Slocan Divisions as well as consultants to the corporate office in order to review and seek input on the corporate strategies.

3. Defining Adaptive Management

There are two main underlying themes in the range of definitions for AM found in the literature. The first is that AM is a commitment to some type of structured learning process whereby legislation, policies and practices are considered experiments to be tested, with the resulting lessons used to modify them as required. The second theme is that an AM approach recognizes that change is inevitable and uncertainty a given, hence it is necessary to understand how to work with, rather than plan to eliminate, these factors. As a result, the following is the AM definition used for the purpose of developing the AM framework:

> *AM is the process by which a commitment to learning is used to adjust management strategies so as to better cope with change while simultaneously seeking to better understand how management goals can be achieved.*

The literature also defines a variety of AM methods used in pursuit of learning. It has been suggested that the array of interpretations of AM is one barrier to successful implementation (Halbert 1993). Forest companies will likely benefit from maintaining a broad definition of AM. However, it is necessary to create a common understanding of AM and the associated methods, and build capacity for critically assessing situations to determine what AM approach may be most cost-effective for any given issue.

3.1 Parallel Learning

In the literature, AM is generally acknowledged to be a term coined by research scientists at the University of British Columbia. In this view, AM is seen to be a technique, which includes required elements for conducting large-scale operational experiments to help understand complex systems, where the potential implications of differing management strategies are simultaneously examined. This interpretation is commonly referred to as active adaptive management. The term "parallel learning", as used by Bormann and Martin (1996), is preferred by the authors of this report as it captures the key concept of comparing different policies simultaneously. An inherent principle is that parallel learning involves taking management actions deliberately designed to be informative and which may not solely focus on greatest yield, rather there is also an attempt to address uncertainty (Hilborn 1992).

Bormann and Martin (1996) make a further distinction with respect to parallel learning, suggesting that there are two general approaches: comparative management and experimental management. The former involves the simultaneous comparison of at least two different management approaches, where simple comparisons are made on roughly similar initial conditions and the approaches are assigned randomly. The greater the certainty of differences in the initial conditions, the higher the quality of interpretations. It is suggested that monitoring may be less intensive when there are large differences in the management approaches. In general, comparative management does not include replication, thus the results are less certain and, therefore, may be limited to the immediate area and time frame.

Experimental management uses the comparative approach but includes replication. This is believed to be the most effective approach for improving our knowledge in order to support future decisions. The experimental approach is likely necessary when comparing complex prescriptions. If there is no monitoring, good documentation is required so that the approach can be relocated and learning achieved in different locations. It is suggested that the experimental management approach can be used at either the stand or watershed scales. The latter would be more expensive and time consuming but useful for addressing broader policies, regulations and issues, thus there is potential for important advances. However, it is generally an untested approach (Bormann and Martin 1996).

For some, AM is narrowly defined as parallel learning or active adaptive management. As a result, it has been suggested that there has been little real experience with AM as most attempts do not proceed beyond the design phase (Walters 1997). On the other hand, AM is considered to be a concept that involves a collection of principles and a high degree of flexibility, which are necessary to understand the complex systems and potential implications of differing management strategies. This latter interpretation views parallel learning as only one of various means of implementing AM.

3.2 Sequential Learning

A second approach is what many call passive AM, or what Bormann and Martin (1996) term "sequential learning". There is recognition for the need to learn by examining what actually happened relative to what happened in the past. Questions and anticipated outcomes are clearly defined and monitoring plans are written before implementation of management strategies. The monitoring allows for learning about the selected management strategy, through evaluation a decision can then be made to either continue with implementation of the strategy or revise the strategy. A change in approach then triggers further monitoring, hence the sequential approach to learning – one concept at a time, followed by monitoring, revision further monitoring, etc. The key is a commitment to monitoring, when the commitment wanes, the learning reverts to reactive. Thus determining priorities for monitoring is a key element of design (Hilborn 1992). Sequential learning requires patience as it may take time to identify and evaluate the consequences of a

strategy. Additional time is then required to change the strategy, if needed, and conduct further monitoring and evaluation to determine if the changes were advantageous. While this approach may involve considerable time as well as resources for monitoring, it may be necessary when immediate action is required or when operating on a management area that is thought to be unique. It could be helpful to identify trigger points in order to facilitate adaptive change. This form of sequential learning is termed "experimental management" by Bormann and Martin (1996).

An alternative approach to sequential learning is "intervention management" (Bormann and Martin 1996). In this approach, predicted outcomes are recorded and a baseline of useful variables is monitored *before* the management action is taken. Intervention management might be useful where the geographic scale associated with the issue is large but where there are limited opportunities to define similar areas for a parallel learning approach. The main problem is the general lack of long-term databases to establish pre-treatment conditions.

3.3 Reactive Learning

A more traditional approach to learning has been termed "reactive", when change is driven by stimuli external to the management system, including legislation, public reactions and research findings. Feedback does occur and adjustments are made. However, problems arise when "different stimuli conflict and the rate of change outstrips the rate of learning" (Bormann and Martin 1996). In this context, decision-making can be difficult as input from scientists and the public may not be constructive nor applicable to the situation. As a result decisions may be restricted and, with delay, options can be restricted or lost.

3.4 Flexible Management

The above three approaches to AM – reactive, sequential and parallel – are common themes in the literature. An additional view on AM suggests that "flexible management" is often the goal being sought and sometimes the preferred approach of industry (Halbert 1993). Where policies and regulations are developed for large areas, practioners may be seeking to adapt the broad direction to local knowledge and conditions. Flexible management is chosen when new but localized information becomes available, however time pressures make it difficult to wait until the change can be applied more broadly. Managers may decide that it is not worth seeking wholesale change, rather minor changes or flexible interpretations of the existing policies and legislation are considered to be the most cost-effective approach. The emphasis is on seeking agreement from regulatory agencies and other stakeholders for implementing the minor changes or creative interpretation of the rules. There may be little or no monitoring, depending on the degree of support that is garnered for the adaptation. As a result, this approach can raise questions of accountability and effectiveness relative to an integrated set of values.

4. Theories and Realities

The following is an overview of key underlying concepts and/or rationales for pursuing AM, which are discussed in the literature. The concepts and rationales are discussed in relation to potential implications for, or questions to be considered by, corporate forest interests.

4.1   The Need to Learn Faster

At its most basic, AM has been proposed as a mechanism to speed up the pace of learning. Resource managers, government staff and interested and affected stakeholders are constantly learning. However, it has been suggested that much of the learning has been reactive. Namely, without the benefits of a carefully designed process that is intended to promote learning through a structured monitoring and evaluation process, managers have learned from their errors in a manner that has been informal and slow (Hilborn 1992). The underlying assumption is that we

need to learn faster. At a societal level, fear triggered by trends such as loss of species, loss of economic opportunity and/or loss of future options can be the motivation for action, which people may feel needs to be supported by faster learning.

A forest company may have many reasons for needing to learn more quickly. For example, regulatory agencies, other stakeholders and community opinion leaders may lack confidence in the ability of the compay to pursue their proposed activities without unduly impacting other economic and non-economic interests. Hence, the company must demonstrate sufficient knowledge to gain their confidence in order to access the required resources. The corporation may need to demonstrate such knowledge in a relatively short period in order to avoid adverse economic impacts, e.g. running out of wood for a mill. A company may also need to learn faster in order to create a better internal balance and creative tension between achieving short-term profit goals and ensuring long-term options for its interests are maintained.

The literature review identified that, although AM is proposed as a vehicle for addressing the complexity of sustainable resource management issues, to date the initial focus has been on exploring ecological resilience and then considering how human utilization of resources can be sustained within that concept. However, some of the reasons for needing to learn faster may be economic. Yet there were no examples found within the literature that sought to use AM approaches to explore economic resilience as a primary focus, and then seek to describe its relationship with ecological systems.

Hence, the reasons for faster learning need to be clearly articulated to determine if the rate of learning is the only or even primary concern. It may be that what we are learning (or not learning) and the quality of that process, including our ability to respond to lessons learned, is equally or more important than the speed at which we learn.

4.2   Uncertainty and Risk

One of the key reasons suggested for utilizing an AM approach is that resource management operates within the context of considerable uncertainty. Efforts to deny the depth and complexity of the uncertainty by seeking agreement on a single best approach to bring certainty have often been unsuccessful. In some cases lack of success means an inability to effectively implement the strategy on the ground. In other cases, it may mean that the overall management objective, for example fish populations that can sustain a desired level of harvest, is not met. Berkes et al. (2000) suggest that the historic quests for certainty implied an assumption of ecological stability, where stability is characterized by rules and regulations, maintenance of predictable yields (with a focus on controlling the resource to increase predictability) and quantitative techniques. Such management appears to cause a gradual loss of resilience as well as a reduction of variability and opportunity, thus moving ecosystems toward thresholds and management to crisis-type interventions.

When the public, media, stakeholders and/or decision-makers perceive a crisis, uncertainty is further complicated. Halbert (1993) suggests that in such situations, sub-optimal decisions can be made. It becomes the difference between making decisions to address uncertainty versus decisions to address controversy.

When access to resources becomes controversial, there is a tendency to seek certainty through planning processes. More than a decade of land use planning in B.C. has been undertaken to address the need for certainty. The call for certainty has come from many jurisdictions, including the forest industry sector. If planning processes can help foster the necessary good working relationships between all affected parties, then some degree of certainty may result. However, in areas where the issues are highly contentious, the focus has been on negotiating "a solution" that will bring certainty. Proponents of AM support the call for integrated planning processes, however the emphasis is not on defining a single set of rules that can stand the test of time, rather to acknowledge uncertainty and use it as a basis for developing an appropriate plan. In order to

pursue an AM approach, it will be necessary for a forest company to clearly communicate its views on certainty – how it relates to broad corporate goals as well as its influences on sustainable forest management.

Hilborn (1992) identifies three types of uncertainty:
1. noise – things which have been identified as a variable and that we have some experience with;
2. uncertain states of nature that have been identified but we lack experience with, and;
3. surprises, which are aspects we have not considered. As a result, addressing surprises can consume an abundance of resources.

AM is premised on the idea that interventions should be structured in ways that anticipate or take advantage of surprise as tools for learning, rather than avoiding or merely reacting to inevitable surprise (Bormann et al. 19944). Given that uncertainty applies to both technical and social aspects of resource management, the complexity may be overwhelming to many. Is it possible for a broad array of stakeholders and decision-makers to make the necessary commitment to learn about the complexity so that oversimplification of the issues can be avoided?

Simply acknowledging uncertainty is insufficient because when uncertainty prevails, legal mandates and formal rules emerge. These conditions can limit the creativity and responsiveness of managers to site-specific conditions and/or local knowledge, as well as lessons learned through well-designed experimental approaches. For the forest industry, rigidity in rules can translate into higher planning and operational costs, particularly if the rules are ambiguous and require considerable effort to translate into operational realities. Additionally, the higher costs may lack benefits that are seen as necessary and/or sufficient to meet the non-timber objectives.

It has been suggested that when managers and other involved stakeholders are willing to accept that uncertainty is, and will remain, the predominant management context, then AM offers a means to move forward. Through an AM approach, uncertainty is described and translated into risk, thus enabling a move away from being dominated by that which is not known to understanding risks of going with what you do know relative to inaction. It can be argued that the forest industry is already operating in this manner as many, if not most, acknowledge that existing information about ecological systems is, and will continue to be, incomplete. However, cutting permits continue to be issued and trees are cut on a regular basis. So how is an AM approach different from status quo? The answer lies in the thoroughness and degree of scientific rigour adhered to, along with the scale and scope of issues to be addressed.

4.3 Linking Science and Management

For some authors, at the root of AM is a conscious choice to effectively link science with management so that each responds to the needs and information of the other (Meretsky et al. 2000, Halbert 1993, Salafsky et al. 2002, Marzluff et al. 2000). In this view, neither science nor management is consistently subordinate, rather each has its own priorities to be understood and reconciled through design of the project and process (Table 4.1). Managers need to actively participate in the design of research projects to ensure that results are relevant to the ongoing issues for which they must make decisions. Research scientists, on the other hand, assist managers in drafting, implementing, monitoring and evaluating policies, which are considered to be experiments that require testing.

There are a number of scientific concepts that have been identified in the literature as being desirable to more fully integrate in sustainable resource management through AM approaches (Halbert 19935, Bormann and Martin 1996, Hilborn 1992). The following is a brief discussion of key scientific concepts that researchers and practioners suggest need to be incorporated into AM approaches and how they help forge common ground between research and management.

Table 4.1 Historic and Possible Roles for Research Scientists and Resource Managers
(Bormann and Martin 1996)

Research			Management
Traditional Roles	**Possible Common Ground Under AM**		**Traditional Roles**
Focus on finding general understanding that applies well across wide areas and over a long time	Test general understanding at a specific time and place	Invest more in broader landscapes and over longer time frames	Focus on the landbase being managed to the exclusion of other lands and on short time frames
Historical bias in ecology toward natural ecosystems	Recognize that management is a dominant ecosystem process	Increase value of other resources including information	Historical bias toward managing trees
Maximize independence and credibility	Help interpret management experiments and monitoring	Support independent monitoring and analysis of management experiments	Work as a coordinated management team
Interest in an understanding of factors in isolation of other factors, usually at small scales	Accept more complexity and study whole ecosystems response	Accept that multiple approaches to achieving a single objective increases learning	Interest in effects of a complex mix of practices (prescriptions and land-management plans)
Focus on extreme treatments to speed learning	Promote parallel learning (e.g. replication, randomized assignments where possible)	Compare more than one strategy at the same time.	Interest in comparing the current strategy with past strategies
	Participate in design of management	Participate in setting research priorities	

4.3.1   Documentation

Research science highlights the need for a disciplined and thorough approach to documentation. Key factors include deciding what to record, how to measure and how to store the information. Alternatively, there is pressure for managers to be brief in developing their plans because decision-makers and other interested parties are often overwhelmed with unfocussed information and, as a result, will not read more than a short summary report. Additionally, unlike research where failure to positively approve a hypothesis is often recognized as beneficial learning, it is rarely acceptable for a manager to fail to reach their management objective. Such "failure" can undermine credibility and public trust where the expectation is to define and deliver the "best" approach. Documenting uncertainties and risks to be taken by resource managers is generally not standard practice at all levels within the system. In particular, when organizations publicly communicate their decisions, the emphasis on the positive aspects of the decision can often minimize or even eliminate the references to uncertainty and risk. This is true for both corporate and non-corporate interests.

Finally, documenting rationales for decisions can illuminate personal biases or other non-conforming bases for decision-making. While it could be argued that the incorporation of scientific concepts is intended to remove biases, is this always desirable? Are there some benefits to

having "doers" who know how to "work the system", which might be lost through more comprehensive documentation of decision rationales?

Forest companies need to carefully consider documentation needs. AM is a learning process that requires good documentation, yet the extra resources required and concerns relating to confidentiality and exposing non-conforming decision-making rationales are trade-offs to be addressed.

4.3.2   Comparison, Randomization and Replication

Research science brings a structured approach to management experiments that involve comparison (controls), randomization and replication. Comparing a diversity of approaches can make differences easier and cheaper to detect, provided that each approach is valid. Replication can be used to show more reliable results and, therefore, support application to the broader land base, while random allocation of approaches can overcome personal bias. Thus, it is argued, these scientific principles need to be incorporated into design of management practices in order to establish causal relationships (Halbert 1993). These principles can be used to undertake iterative hypotheses testing, which can identify limitations of status quo patterns and perceive new patterns (McLain and Lee 1996).

However, management decisions often relate to broad landscapes and complex systems. Can such systems be replicated and controls defined? Do we have sufficient understanding so as to apply randomness to complex learning objectives in a manner that doesn't obscure a key cause and effect relationship? How can the design process help address these questions? How long will learning take? It has been suggested that a relatively short learning time may be needed for successful implementation of AM but is this feasible for SFM questions? How much would monitoring and evaluation cost? To achieve AM goals, both research scientists and managers will have to make short-term compromises, which become part of the risks that need to be documented and factored into design, to the best of our abilities. The challenge for a forest company is to understand how such compromises relate to their interconnected, but sometimes conflicting, goals for short-term profitability and long-term sustainability.

4.3.3   Systems Models

A key tenet of AM is that practioners must use the design process to first describe a complex system in a relatively simple conceptual model so as to understand the effect of potential change to the system. This implies defining targets (Salafsky et al. 2002). Some proponents of AM question the validity of running a small number of very detailed scenarios. Rather, it is suggested that we learn more by "playing" with scenarios and testing sensitivities to various factors to support an AM approach rather than doing massive runs that lead to a defined management solution (Walters 1997). In other words, complex models can not identify an optimal approach, rather they can compare scenarios. McLain and Lee (1996) suggest that system models can facilitate iterative learning about ecological systems and relationships at different scales. The models enable a variety of scenarios to be developed as a means of exploring "what if", but they note that the outcomes are constrained by assumptions. Hence, the conclusions only represent one reality. There may also be the perception (real or otherwise) that models are constructed to favour particular interests (Bormann et al. 1994).

AM may result in using simpler models to clarify what is best to try in the field. The underlying issue is whether the costs versus benefits of detailed modeling will demonstrate greater value than in-the-field trials. In other words, can models be an alternative to field trials? Parallel learning may be required when it is recognized that modeling can not be an alternative to field trials. Walters (1997) suggests that one barrier to successful implementation of active AM is that "modeling for adaptive-management planning has often been supplanted by ongoing modeling exercises, apparently based on the presumption that detailed modeling can be substituted for field experimentation to define "best use" policies. There is a further presumption, in such

exercises, that best use policies can be corrected in the future by "passively adaptive" use of improved monitoring information".

The design of an AM approach begins with a concerted effort to integrate existing interdisciplinary experience and scientific information into dynamic models that attempt to make predictions about the impacts of alternative policies (Walters 1997). The modeling step is intended to serve three functions:
1. problem clarification and enhanced communication among scientists, managers, and other stakeholders;
2. policy screening to eliminate options that are most likely incapable of doing much good, because of inadequate scale or type of impact; and
3. identification of key knowledge gaps that make model predictions suspect.

Knowledge gaps usually involve biophysical processes and relationships that have defied traditional methods of scientific investigation. The modeling processes often identify that the quickest, most effective way to fill the gaps would be through focused, large-scale management experiments that directly reveal process impacts at the space-time scales where future management will actually occur.

Perhaps one of the most important results that can be obtained from the modeling phase for a company is to determine if, and under what circumstances, it may be necessary to abort an AM process. An alternative to aborting is to move to advocacy and all the inherent difficulties (Walters 1997) or to "muddle through".

The discussion on modeling within the literature demonstrates considerable experience with using models to predict the consequences to the ecological systems relative to a variety of scenarios. The predicted consequences presumably include specific economic and social impacts (e.g. impacts to timber supply, availability of unroaded backcountry recreation opportunities), to the extent that they can be modeled. However, there were no specific references in the literature as to how models can and have been used to understand the consequences to economic or social *systems* based on various scenarios nor any discussion on the significance of this gap.

4.3.4   Scale and Scope

The research scientist contemplates scale and scope as required to define cause and effect relationships. Historically, this has tended to result in experimentation at relatively small scales and with considerable efforts made to isolate what were thought to be key factors. Management, on the other hand, is forced to consider scale and scope relative to the geographic and temporal implications of the issues, as well as defining boundaries (lines on the map as well as defining the issues) so that they have social meaning for stakeholders. Proponents of AM suggest that many problems only become apparent in settings of sufficient scale and complexity and, therefore, AM needs to be applied to large scale ecosystems (Lautenschlager, Meretsky et al. 2000). Such a scale is appropriate because while small- scale investigations need to continue, they alone can not provide all the necessary knowledge. Additionally, large-scale ecosystem level interventions are already occurring through past and current policies and legislation, which are being implemented by different administrative entities.

Others argue that experimentation is easiest at the tactical scale because at a larger scale, i.e. the strategic scale, it may be more costly, complex and ethically questionable to experiment (Halbert 1993). It is suggested that AM may be best suited to problems that involve a lesser degree of complexity. At the larger scale, computer modeling may be more appropriate. While this may be the case for some experimental management approaches for parallel learning, a broader definition of AM may identify different and more acceptable approaches. Yet, it seems reasonable to question if large-scale experimentation on complex systems will produce results that can clearly define cause and effect to the extent that affected stakeholders will agree on the

necessary responses. In order to implement AM, researchers need to "focus on costs of reduced replication and design creative ways to increase the statistical power in a constrained experimental setting" (Marzluff et al. 2000). Hence, there may be tradeoffs in the ability to conduct experiments at large spatial and long temporal scales. To address this, a range of research may be required across all scales and reflecting varying degree of complexity, along with effective mechanisms and structures for integrating the efforts and evaluating the cumulative results. If a corporate interest initiates large-scale, long-term projects to achieve their particular goals, will they also have to educate or even train people from other organizations to ensure successful implementation?

4.3.5   Sub-Optimal Options and Outcomes

If AM is to reduce uncertainty as rapidly as possible, it may be necessary to undertake actions that do not appear to be optimal but will provide good information about the system. For example, an experimental approach may use a combination of over- and under-fishing. This may lead to some experimental designs being ethically questionable to at least some participants. The benefits of additional knowledge will need to be assessed relative to the potential adverse effects. While the "intensity and extensiveness of our trials can generate errors that are potentially larger than society can afford" (Halbert 1993), proponents of AM suggest that the opposite may also be true. The question is how to decide when to experiment? What criteria and processes can be used by a forest company to address ethical choices for experimental approaches?

The consequences of experimental outcomes and errors of inference often differ dramatically among stakeholders, hence there is a need to understand how to distribute benefits and costs equitably (Lertzman 1998). As a result, individual stakeholders will prefer different designs due to contrasting interests. In many cases, there is a trade-off between what is needed to be learned and economic goals. Furthermore, when the economic context is considered, different designs may be selected from that which would be considered the "textbook" experimental design.

4.3.6   Monitoring

In linking a scientist's approach to monitoring with a manager's need for evaluation and adaptation, the emphasis becomes one of good up front design, with clearly defined learning clients and objectives. This involves documenting anticipated outcomes and assumptions in advance of implementing the management actions in order to minimize bias (Bormann and Martin 1996). For Duinker (1989), developing anticipated outcomes for complex systems requires that monitoring be supplemented with process-based simulation modeling to detect impacts. It is suggested that this helps reduce costs because it is based on forecasting models that have already been developed for the project design phase. The simulation models are sets of explicit, quantitative hypotheses of how a system is structured and how its components interact over time.

Part of up front planning for monitoring is to be clear on what is to be achieved through such efforts. On the one hand, it is suggested that monitoring compares the anticipated outcomes versus the actual. This may require identifying specific thresholds or trigger mechanisms where, once reached, clear consequences result (Bormann and Martin 1996). Duinker (1989) states that "monitoring of environmental impacts is impossible, rather monitoring is undertaken in order to reduce uncertainty in predictions". Thus the forecasting model is critical in terms of the expectations and descriptions of uncertainty that result. Duinker (1989) also suggests that the "only reason to go to the expense and bother to obtain a time series through monitoring is to check predicted time series for variables being monitored".

While the literature strongly emphasizes the need for good up front design monitoring plans and solid follow through in terms of actually conducting the monitoring, there is comparatively little written about the evaluation process. This may be due to the fact that many AM proponents and authors are scientists, including biologists and ecologists, who may be most familiar with providing advice to decision-makers. Therefore, an identified gap in the literature is how the

evaluation phase of AM is used to translate monitoring data into shared knowledge, which can be acted on.

4.3.7 Follow Through

Another potential contribution of scientific thought to AM is the concept of follow through. Arguably the most difficult step for management is to move beyond analysis to making a change in behaviours. The use of peer reviews, including blind reviews, may be borrowed from research science to overcome the tendency to avoid change (Bormann and Martin 1996). However, the ability to make such changes may not lie with forging a better working relationship between research scientists and managers, rather it may require the integration of these two with social issues that are understood through relationships with broader community interests.

4.4 Linking Science and Management with Broader Community Interests

Stankey and Shindler (1997) state that, historically, forestry has been governed by a scientific rational paradigm that supported the notion that issues could be resolved by technically and scientifically trained professionals. They suggest that scientific planning processes may lack the richness necessary to generate meaning, which, in the language of corporate managers, means sustainable and operationally feasible actions. AM has potential to draw attention to the limitations of the scientific approach because:
- technical knowledge is theoretical in nature, reductionist and functional in scope and limited in its ability to extrapolate to other situations. Therefore, when it is applied to a specific issue and/or area, there can be unexpected consequences;
- experiential or personal knowledge exists about places, which institutions find difficult to integrate. When local knowledge is discounted, institutions discount the political aspects of the issue, and;
- facts involve meanings assigned to them by experience, training, values, etc. This challenges the concept of value-free and objective science (Stankey and Shindler 1997).

AM is considered a vehicle for addressing these challenges because it can help form the necessary linkages between science, management and broader community interests.

4.4.1 A Twist on Traditional Public Involvement Strategies

The public participation theories that were developed and tried in the 1970's, 80's and 90's have been integrated with scientific research and management traditions to suggest that AM will assist when conflict is entrenched (Wieringa and Morton 1996). Traditionally, if attaining agreement on management objectives was difficult, the resultant objectives tended to be vague statements of compromise. The ability to interpret the objective and define operationally feasible strategies for implementation to achieve the objective has been largely dependent on whether the planning processes were able to foster the necessary working relationships between participants. A question raised by AM is, if it is difficult to get agreement on management objectives, can a commitment to structured learning help break the impasse and enable the eventual development of clear and specific management objectives?

The authors suggest that a basic lesson learned from public participation efforts of the past has been that consultation is effective when two key criteria are met:
- the proponent's objective is to build understanding and trust through an investment in long-term relationship building, where past performance on the part of any participant has not precluded the ability to do so, and;
- if key stakeholder representatives are interested in working to define reasonable options for development and are effectively represented in the process.

These two conditions can result in the necessary give-and-take over time. The focus for consultation on a specific decision then becomes one of reiterating the understandings that have developed and discussing particular aspects of the issue at hand. The trust that has been built over time, combined with any new insights particular to the decision in question, then form the basis for the decision-maker to proceed. If, however, there has not been an investment in long-term relationship building or key community interests are not interested in the type of development being proposed, and a proponent is required to make a decision that is controversial to any degree, then the public participation effort is not consultation. Rather the proponent will be required to engage in some form of negotiation, mediation or arbitration in order to define workable solutions. The proponent may be required to work directly with the community/global interests that are opposed to their proposal and/or regulatory agencies that have a suitable mandate for integrating competing interests across the land base.

Based on this assessment of public participation, what might be the opportunities and implications for an AM approach to achieving sustainable resource management? It seems logical that, in situations where the above two key criteria are met and the substance of discussion involves very complex and controversial issues, it may easier to find agreement on a structured learning process than on what constitutes a single best practice. However, where the above two criteria are not met and the issues are complex and controversial, it seems likely that the intense and lengthy negotiations that have come to characterize such situations will be extended to defining:

- what is known;
- what is unknown;
- how to translate uncertainty into acceptable risk, and;
- the appropriate structured learning process to assess the ability of one or more strategies to achieve the goals within the defined acceptable level of risk.

Some of the inherent challenges imbedded in such a process include:

1. Developing a new approach to talking with communities around uncertainty and risk. There may be need to borrow from the science of cognitive psychology to understand how affected people perceive and process information about probabilities. It has been suggested that the key is to know your audiences and what they require in this regard (Lertzman 1998);

2. Redefining consensus within the context of AM. The push to achieve agreements may not always result in good decision-making (Gregory et al. 2001). Whereas consensus, or complete agreement, has been defined as the desired decision-making process, negotiations to resolve conflict may involve a narrowing of perspectives. AM examines conflict to determine if it can or should be used as a basis for broadening the scope of management practices and developing experimental approaches. Thus, within an AM approach, agreements reflect the goal of learning so as to help maintain or build adaptive capacity, rather than seeking agreement for the sake of resolving conflict.

3. Blending the scientific research approach to designing experiments with local knowledge and perspectives. There is evidence that many ancient civilizations practices the art and science of AM, thus sustaining high population densities in the face of scarce resources (Stankey and Shindler 1997). Berkes, et al (2000) suggest that traditional knowledge a "consequence of historical experience with disturbance and ecological surprise, and of not having access to modern technology and socioeconomic infrastructures with which disturbance can be exported in time and space". As such, many prescriptions of traditional knowledge may be generally consistent with AM. The relevancy of local knowledge may extend beyond what many would consider to be "traditional" knowledge associated with "ancient" cultures to the practices of present day resource users, some of whom develop a broad understanding of the resource and the linked social-ecological systems at cross-scales (Olsson and Folke 2000). Thus, their attitudes and behaviours resemble an ecosystem approach with elements of AM. While the existence of knowledge on the part of local users does not imply sustainable

ecosystem management, it is necessary to consider how to incorporate such knowledge in order to understand what, if any relevance there may be, and;

4. Addressing the hard costs and complications that are likely associated with careful process design as well as on-going monitoring and evaluation through a group process. AM has the potential to increase the number of difficult management decisions by revealing new problems and new possibilities more rapidly. However, proponents suggest that it can also permit more rapid resolution of such problems (Meretsky et al. 2000). Halbert (1993) suggests that costs of AM need to be considered as trade-offs between:
   - the value of reducing future uncertainties;
   - costs of observations during learning;
   - long-term economic value of learning;
   - level of random variation;
   - discount rate of future value of resource; and
   - applicability of results to other management situations.

5. The need to sustain the commitments necessary to enable consistent follow-through in order to realize any gains. In one instance an agreement was reached to allow one season of over fishing to be followed by a complete closure the next season. Following the first season, industry successfully lobbied government to maintain a fishery the next season despite originally agreeing to the concept (Halbert 1993). Political interference can come from any direction to undermine the process at any step along the way. The likelihood of successful interference increases as time passes and commitments to original agreements soften. This has considerable implications for structured learning processes that are intended to unfold over many years.

4.4.2   The Current Context for Public Involvement

There are two relatively new factors to be considered in bridging the gaps between professionals (both researcher and managers) and communities. Firstly, while an agreement may be reached with local interests, management must now consider national and global pressures to produce products that are certified by independent organizations with externally defined standards. Can an AM approach assist a forest company in meeting the sometimes conflicting requirements of regulatory agencies, local community needs and nationally/globally defined certification standards? The key may be to what extent any of the regulatory or market forces reflects sustainability. History has shown that regulations and standards evolve over time. If, in fact, the concept of sustainability remains a moving target, it may be that an AM approach could help maintain the flexibility necessary to address future shifts or new evolutionary stages.

Secondly, it has been suggested that very deep value conflicts within the community of ecological and environmental management interests have become more of a barrier than traditional ecological/industry conflicts (Walters 1997). What then is the appropriate role for a forest company when there is need to have the conflict resolved in order to move forward on their particular issues?

So does AM hold the promise of breaking gridlock and enabling a forest company to better seek agreements with other stakeholders, while maintaining (increasing?) access to markets and increasing efficiencies in the process? The answer lies partly in a subsequent question, namely is the company willing to invest in long-term relationship building? Have historical relationships in some areas precluded the ability to build effective working relationships? If there is a willingness to build long-term relationships then, in the short-term, and if measuring costs solely in terms of time and expenses incurred to reach an agreement on the immediate issues, AM will likely be considered added costs to current operations. However, in some situations there may be little alternative as the cost of negotiating a "best practice" solution is recognized as unacceptable because it fails as practioners attempt to apply it on the ground. Additionally, if costs are measured relative to not only current operations but also future opportunities, then the costs and

benefits may be viewed differently. These are questions that forest companies have already faced as part of calls for increased public participation in decision-making over the last 20+ years. The fundamental difference is that the public participation requirements of the past were often led and/or required by regulatory government agencies. AM can be one potential response to market driven forces that are largely driving the push for redefining operational sustainability and which require companies to demonstrate continuous improvement in their SFM practices.

4.5   Are Organizations Risk Averse?

Numerous sources suggest that institutions are risk averse and have an inability to admit failure (Stankey and Shindler 1997, Bormann et al. 19944, Halbert 1993). AM is based on learning more quickly, including accepting that the fastest way to learn may be to nullify a hypothesis or, in the words of managers, to fail to successfully implement a strategy and/or achieve an objective. Given that most organizations view such failure negatively, there appears to be a built-in aversion to AM. Furthermore, the risk can be characterized as a perceived threat to existing interests. The threat to existing management structures is due to the fact that AM deliberately sets out to learn from experience, as opposed to using agreed upon strategies to confirm one selected management direction (Halbert 1993). As a result, there can be a disconnection between knowledge and action so that study becomes a means of avoidance. The inability of an institution to take risks can also compromise its ability to design a good project and policies that can support learning (Stankey and Shindler 1997). A review of numerous case studies by Gunderson et al. (1995) concluded that such inertia within institutions leads to failure, followed by a shift to the political arena. A common political response is the creation of a new institution, often with little resolution of the underlying issues.

The suggestion that institutions are risk averse strikes the authors of this report as being overly simplistic. Individuals within organizations are constantly taking risks, often with tacit approval of their supervisors. The desire to "make things work" leads people to risk manage contracts when formal approval for funding is slow to be given. Resource managers who live and work in small communities often commit to extra studies or special measures to address local concerns, all the while risking the establishment of precedents for themselves and others in their organizations. Deal making in reviews or on the ground in order to get a permit approved is a standard practice and one that is rarely documented. Finally, while staff may be willing to assume risk, it may be that the information they are presented is risky. These are only some of the risks which individuals within institutions regularly assume.

At an institutional level, organizations are constantly making decisions that contain an inherent element of risk. The hiring policy and overall corporate structure reflects an organization's response to perceived risks and opportunities. A small workforce, combined with use of consultants, may enable a corporation to retain greater flexibility to respond to external changes. However, if for whatever reasons, the insights introduced by the consultants are not sufficiently integrated into the daily operations of the corporation staff, then the corporation can become overly dependent on the outside experts, thus reducing its overall flexibility. The development of a sustainable forest management framework (SFM), in partnership with academic, government, community and other industry interests, together with the decision to seek CSA certification, are additional examples of decisions that have inherent risk. The development of SFM framework is a large undertaking, which will hopefully enable a forest company to be increasingly proactive to the inevitable changes in forest management. Yet many aspects of SFM remain untested. Additionally, SFM is anticipated to result in meeting any credible certification process however, CSA certification requires public input at the local level. Will local residents be willing to adopt a plan that contributes to sustainability at a broader scale if there are negative short-term implications for the local community? Finally, will investments in developing and implementing SFM be compromised by oil and gas or other industrial and commercial activities that are not required to meet such standards?

If the reluctance to take risks is seen as a barrier to successful implementation of AM and yet organizations routinely do take risks, then it may be necessary to consider what type or level of risk are at the core of the issue. To do so, the following is a discussion on two consistent themes within the literature, that being the importance of temporal and spatial scales for AM approaches.

4.5.1   Creative Tension Between Short- and Long-Term Goals

Much of the literature focuses on the role of public agencies that have a broad mandate with respect to resource management. Such agencies are largely governed by the short-term political agendas that align with the election cycles. Yet policy effects cannot appear any faster than the operation of dynamics in the system being managed (Baskerville 1995). As the goal of learning usually implies a longer-term horizon, AM is often in conflict with the agency cycles. Hence, the issue is to find a workable balance between the short-term political realities and longer term needs for learning. Thus the organization assumes risk if it can not attain an effective working balance between the short- and longer-term agendas. When the short-term political agenda dominates, AM approaches will be unable to move beyond the planning stage to implementation. Conversely, if the longer term learning agenda fails to recognize and address the short-term political agenda, then the project may be aborted mid-stream, resulting in a substantial waste of resources.

The parallel for corporate interests is the need to develop and institutionalize a creative tension between the short-term profit needs compared with the longer-term maintenance of future options. Like the short- and long-term needs for public agencies, the two corporate agendas are linked. Short-term profit goals may be defined as meeting the expectations of shareholders as well as how company profitability supports broader short-term social and economic goals. The latter may be defined as not only the need to maintain future harvesting opportunities, but also to meet society's expectations for longer-term social responsibility so as to maintain the positive relationships that are required to realize future harvesting opportunities. The assumption of an AM approach is that a company believes that one goal is not attainable without meeting the other. The risk for a forest company is when the linkages become blurred through dominance of either the short- or long-term needs. An effective internal creative tension develops when senior management defines clear, unambiguous corporate SFM goals that galvanize the organization while simultaneously encouraging constructive debate.

The clear corporate goals then shape how the company works with external parties to define the issues and potential responses. Ambiguous corporate goals, or ones that blur the relationships between the short- and longer-term corporate needs, risk reducing the range of realistic options that the company can pursue. It also infects their approach to framing and publicly discussing the issues, which can entrench the disparity between the two temporal scales by seeking to reduce the complexity and deny the uncertainty, thus further limiting options.

4.5.2   The Challenges of Spatial Scales

Planning and decision-making processes tend to use administrative boundaries, which often fail to reflect ecological realities or even key social and economic relationships. There is rarely one line on a map that can be used for SFM given the inherent complexity. Thus, although it is necessary to define a geographic area to use for planning purposes, every possible decision with respect to line work involves risk. They key is to ensure that any given process is effectively nested within a suite of ongoing processes so that the necessary linkages can be made. However, organizations, such as forest companies, are hesitant to engage in areas for which they do not have mandate. A current example is the ongoing work on representation that involves assumptions about management of provincial parks, which may not be achieved through actual practices. There is risk associated with a forest company assuming responsibility for conducting inventories or monitoring within provincial parks as it sets a precedent that could become entrenched as government continues to downsize. However, there is also risk in ignoring the issue because the company's need to meet biodiversity goals and targets is linked to

management in other jurisdictions, such as parks. Failure to meet the targets and goals could impact certification, which is anticipated to help maintain access to markets. Hence, there is risk associated with all potential paths. The opportunity for resolution lies in the fact that all stakeholders, including the provincial government who manages parks but is dependent on revenue from timber harvesting by corporate interests, share the risks to some degree. Therefore, as is the case for the temporal scale aspects of these issues, the key is to avoid oversimplifying the problem, which would enable one or more stakeholders to deny their share of the risks and the inter-dependence of all interests.

4.6 A Systems Approach for Building Adaptive Capacity

Holling (1995) and Gunderson et al. (1995) have proposed a four phased approach to understanding ecological systems that have potential parallels with human systems, which may be manifested through resource management institutions (Table 4.). Case studies revealed patterns of convergence and consistency, followed by quantum change and fundamental re-orientations as existing strategies, myths and understandings become overwhelmed by internal and external events and trends. The key is to maintain resiliency, as opposed to seeking stability and equilibrium, in order to retain the capacity to be adaptive.

Table 4.2 Adaptive Cycle in Resource Management: Similarities between Ecosystems and Institutions (Based on Holling 1995 and Gunderson et al. 1995)

4 Phased Cycle	Systems Implications	
	Ecological	Institutional
Exploitation	Technological advances results in successful exploitation of resources	Traditional planning leads to best use policies with single emphasis management direction
Conservation	Management focus on ecological variables (e.g. fish, trees) that are clearly being impacted by exploitation combined with increasing focus on efficiencies within traditional approaches to exploitation	Seek efficiencies with an increasing focus on how to best realize the chosen option and decreasing emphasis on considering alternative options. Thus there is a narrowing of perspectives
Crisis	Less resilient ecosystems, even when, from an equilibrium perspective, the system may be stable. Increasingly dependent societies on traditional approaches to exploitation. Resource management faced with perpetual surprise in terms of ecosystem response (e.g. beetles)	More rigid institutions pursuing limited options that can not address the non-linear complexity of systems and associated concerns of affected stakeholders. Gridlock results, combined with institutions being faced with perpetual surprise
Reconfiguration	Potential for resource collapse or adaptation involving new views of exploitation and conservation	Potential for institutional demise or renewal that incorporates adaptive approaches to management

The following is a more detailed discussion of key factors that have been identified in association with the four-phased adaptive cycle.

4.6.1   Inevitability of Crises

The four-phase cycle highlights the importance of a perceived crisis as a catalyst for change. The essence of a crisis is when expectations become out of sync with the perceptions that provide the

context (Gunderson et al. 1995). Expectations are defined through policies and can become less flexible through implementation. When the flexibility and adaptability is reduced, there is an overall loss of resilience and less opportunity to bring expectations back into line with their contexts. This results in a crisis.

Baskerville (1995) suggests that the media may be the single most powerful force in forcing institutions to learn. Certainly the media play a very significant role in creating and/or communicating a crisis by reaching a large and diverse audience, many of which might otherwise not express opinions on the issue at hand.

Gunderson et al. (1995) argue that crises within systems, be they ecological, economic or social, are inevitable because as each system matures, there is an overall decrease in resilience. Within an institution, this often correlates to increasing control of information and actions of the participants. This signals the need to restructure relationships. In an institutional context, following a crisis informal collaboration, including people from outside the institution, develop integrated and shared understandings, through which options emerge. Therefore, specific but transient processes result in reorganization.

During the reconfiguration phase, innovation and chance have a dominant role and it is the point where an individual has the greatest potential to create change because the system is dissociated. It can be argued that the current era is one in which mavericks are wielding considerable influence. Crises result in the release of accumulated capital, which can be described as energy and resources within any system. As a result, what some may consider collapse, such as a crash in a fish population or the closure of a mill, can, in an adaptive system, be seen as an opportunity for the energy and resources to be utilized by different aquatic species or to create alternative economic operations. The move from a rigid, highly dependent system to an adaptive one is, therefore, difficult because to break the pattern of conservation leading to rigidity may require a crisis of a relatively large magnitude. Is the current spread of mountain pine beetle an example? Interventions designed to control the system can force it into a holding pattern for a period of time, thus increasing the overall rigidity.

Presumably once the evolution to an adaptive system has been made, the four-phased cycle continues, but the crises or changes are of a relatively minor scale as the overall system has become less dependent on any particular component of the system. Thus the system is more resilient and can "absorb" the change without flipping to a different stability plane. The question for current SFM is whether incremental changes in management can move the economic, social and ecological systems to a more resilient and desirable state in a manner that will not merely build up rigidity, thereby resulting in an unacceptable crisis and reconfiguration at some point in the future.

4.6.2 Resiliency and Sustainability

Wright et al. (2002) suggest that, while it is necessary to understand the resiliency of a system in its current state, resiliency in and of itself is not the goal. It was pointed out that some brutal dictatorships are quite resilient for periods of time. Therefore, it is necessary to define what is an acceptable range of variation for each system that is both desirable and resilient. This understanding of resiliency is then used to socially defind sustainability across the economic, social and ecological systems.

Although the four-phased cycle portrayed in Table 4.2 might be used to define similarities between ecological and human systems, a key difference is likely that human systems have greater capacity for both rigidity and novelty (Gunderson et al. 1995). Thus the greatest potential benefit from the current focus on understanding ecological resilience may be in learning how to transfer the insights gained to overcoming rigidity within human systems and capitalizing on the capacity for innovation. In other words, there is a need to "draw from the growing experience in understanding the operations of complex, nonlinear systems where discontinuous behaviour and

structural change are the norm" (Holling 1995). This "backdoor" approach may be necessary because an initial focus on the rigidity of human systems, including assessment of economic and social resiliency, may be perceived as too threatening. However, unless there is an explicit, up front acknowledgement of the intent and need to do so, the approach to understanding ecological resiliency may preclude extrapolation to other aspects of the sustainability equation.

4.6.3   Rigidity within Institutions

Individuals can play a key role in shaping policy and entrenching dominance through ownership of ideas. Furthermore, ideologies or paradigms can dominant within an institution because people take for granted that such dominance will continue and, therefore, little effort is made to change the situation (Westley 1995). As a result, an institution can become less open to new information until a crisis causes either demise or renewal. On the other hand, strong ideologies, myths and paradigms are important in moving from the planning to the action stages. Thus there is need for processes that forge a meaningful vision and simultaneously open up the organization to new perspectives or information, while still moving it to act.

To counter strong ideologies and yet enable action, there is a need to institutionalize mechanisms that capture and incorporate the evolving knowledge that results from purposeful learning (Westley 1995). Therefore, institutions are not necessarily structured to learn, but to capture, disseminate and use knowledge. Informal, face-to-face communication is often the best way to transmit knowledge. Formal rules can actually inhibit doing so because learning is more connected to the construction of meaning than to rules or authority. Yet the opposite is occurring within many institutions. Due to staff being overwhelmed by their workloads, meetings and workshops are highly structured to "make the best use of people's time", often with little or no opportunity for informal discussion on topics that are of particular importance to participants. Attempts to offer the latter usually fail because staff and their supervisors are hesitant to commit time to an open-ended agenda. This supports Baskerville's (1995) assertion that repositories of learning are usually not formal structures, rather they are found in subcultures within an institution and that access to learning is limited to those willing to invest the time.

Additionally, there needs to be a vertical flow of strategic information because lower levels are often closer to the stimulus and able to more quickly respond (Westley 1995). Empowering those closest to the action is important to maintaining flexibility within the institution, so long as the individuals can do so in the interests of the common purpose. At the same time, it is important to not isolate top managers. At the higher levels it is necessary to create a balance so that no single function becomes overly powerful and influential. In large organizations, middle management is crucial for responsive action as they can be information brokers between the strategic and operational levels. Finally, subordinates must be allowed to challenge the decisions of superiors, without necessarily dominating the outcome but with respect for innovation.

In order to capture the knowledge that results from learning, it is necessary to document decisions, evaluate results and respond to the evaluation (Olsson and Folke 2000). Thus it can be argued that incorporating scientific concepts (section 2.3), with its emphasis on documentation, monitoring and evaluation, can help reduce overall rigidity within an institution. Bormann and Martin (1996) suggest that learning needs to start with an assessment of whom needs and wants to learn. This is followed by the need to balance and coordinate investments in learning, which again leads to closer relationship between scientific researchers and managers, together with the broader community interests. Are shareholders likely to be included in the group who wants to learn and, if not, what are the implications for a forest company's SFM efforts?

4.6.4   Structuring to Embrace Change

If change is inevitable and the goal is to avoid constant change that lacks vision, direction and meaningful learning opportunities, then it is necessary to consider the types of change that can occur and how institutions might structure to adapt within such a context. Westley (1995)

suggests that the interaction between the inevitability of change and how institutions choose to structure themselves results in three type of processes:

1. Periodic bumps – long periods of stability are followed by quantum shifts. While the scope of the shift may be a threat to the institution, it could also be anticipated and accepted as a reasonable trade-off for the long periods of stability. As well, hidden under the major change is often incremental adjustments, undertaken as a result of front-line learning, which can be used to anticipate the major shifts. Planning processes that seek to create stability contribute to this type of change. The problem is that the associated quantum shifts are rarely publicly acknowledged as being inevitable at some point.

2. Oscillating shifts – when institutions are sufficiently loose to allow for divergence without it leading to demise. The key is there are sufficient shared understandings that give meaning to frame the institution's activities, so as to enable a repeated convergence of ideas and actions, while tolerating diversity and the associated divergences. This type of change can occur in parts of the province where population densities are relatively low and there is a high degree of agreement between stakeholders. In areas where the population densities are higher and, therefore, the conflicts can be more intense and entrenched, the necessary shared understandings are more difficult to attain.

3. Regular progress – careful monitoring of new initiatives, while possessing the willingness and creativity to incorporate the emergent knowledge into existing structures. This requires a solid network of professionals and an acceptance that change, while not radical, is continual and so the job is never done. While regular progress would, at first, seem desirable, it requires sustained energy to address the need for continual change. Many stakeholders tire of the discussion and process, thus pushing for a solution that is stable over the longer-term.

Attempts to ensure institutions can respond and thrive in the face of inevitable change, regardless of the type of change that is desired, requires an understanding of where the institution is relative to the four phases of the adaptive cycle (Table 4.2). This is necessary because the window of opportunity to inject innovation is limited, but detectable (Gunderson et al. 1995). Furthermore, it is necessary to recognize that profound change operates at scales that are intergenerational. As a result, Holling (1995) states that institutions need to recognize that there are slow and fast change and a need to focus on the interactions between the two. In many cases, institutions react to fast changes without understanding the linkages to the underlying slow changes, thus cementing a cycle of responding to fast change. Holling argues that monitoring should focus on the long-term slow changes in structural variability.

4.6.5   Role of Individuals

Individuals can play a crucial role during crises (section 3.4.1). However, there are different types of individuals, each with an important role to play. Gunderson et al. (1995) outline three type of individuals who are all important to affecting change within institutions:

1. Visionaries – can be critical to the creation of the crisis that opens the door to adaptation and renewal. Such people are capable of transforming myths for large groups of people as well as spanning the different elements inherent in resource management, including technical information, institutional requirements and politics. Visionary leaders use language that is colourful, emotional and heavily dependent on literary devices to bridge the elements. In essence, visionaries help large groups of people make sense of the complexity (Westley 1995) and bring fragments into the context of new images.

2. Catalysts – who use new approaches and ideas to develop understanding of the system and evolve alternative policies to explore possible futures. Catalysts may be a temporary group that operates outside of formal constraints and functions as a "shadow network". However, in order to be effective, the catalyst needs to have sufficient formal linkages. The catalyst might

include groups of academics and/or consultants. Alternatively, the catalyst may a respected individual with skills at integration who utilizes honesty to connect knowledge to power.

3. Bureaucrats – needed to implement the change. While bureaucrats are often characterized as inhibiting change, which can occur when the focus is on increasing efficiencies in implementation of a set policy that results in asking "are we doing it right?" instead of "are we doing the right thing?". Yet responsive and creative bureaucrats are key to preparing the bureaucracy for change by maintaining strong personal contacts both inside and outside of the institution.

Each type of individual has a role to play, with the relative importance varying at different times. The key for an institution is to ensure that it possesses all three types of individuals and supports them in the essential roles they need to play.

4.6.6   Knowledge as a Valuable Commodity

Bormann and Martin (1996) argue that knowledge, that being the product of learning, must be "considered a resource of equal or greater value than the physical resources that traditionally have been the focus of management". The idea that people should be seen as assets, rather than expenses to be managed so as to achieve efficiencies, is one of the underlying tensions between broad social and economic objectives. The AM proponents may be proposing a twist on the old argument, namely that when knowledge is considered a valuable commodity, institutions can be structured in a manner that best captures, develops, and retains knowledge. This may imply a more flexible approach to balancing costs with investment in human capital. It inserts a commodity to attain (knowledge) by appropriate design of a structure that tries to capture the value of the human contribution to these issues, while not restricting change to the structure.

McLain and Lee (1996) consider access to information and knowledge as key to AM. In order to facilitate access to information and knowledge, it is necessary to evaluate the function of how well information flows within an institution as well as between institutions and between institutions and their environment.

A related topic is corporate memory. Bormann and Martin (1996) feel that corporate memory is needed to support learning opportunities, after all learning is often a longer-term process that would benefit from continuity in understanding. Institutional memory is closely linked to the need for good documentation where assumptions and anticipated outcomes are recorded (see section 4.3.1). There is a need to create long-term records, libraries and databases as well as the capacity to use long-term inventories to extract new information. The challenge is to ensure the long-term records can remain useful as the context for sustainable resource management evolves. Additionally, Olsson and Folke (2000) emphasized that corporate memory needs to incorporate broad local knowledge, rather than be limited to that of the organization itself. Corporate memory is negatively impacted by high staff turnover, lack of mechanisms to retain lessons and lack of long-term staff who remain together as a functioning unit.

In order to build corporate memory with respect to AM, it has been suggested that organizations invest in training, create a sabbatical program or other rewards for people who help an organization learn and adapt, as well as publishing an AM journal that includes:
- documentation of risks, assumptions, anticipated outcomes and learning objectives that are defined up front;
- a peer reviewed section for design and results;
- a resource management section that includes practical information on what worked and what did not; and,
- a public information section that describes the results and implications to values and wants (Bormann and Martin 1996, Stankey and Shindler 1997).

As often noted, the complexity of sustainable resource management means that no one organization can address the issues alone. This implies that inter-organizational memory also needs to be maintained to ensure that key information is not at risk due to the failure of any one institution to retain its memory. This has implications for management-research relationships, contractual arrangements and partnership agreements, including those with sources of learning institutions such as universities.

4.6.7 Planning to Adapt: An Oxymoron?

Gunderson et al. (1995) suggest that traditional planning often leads to failure because it is embedded in bureaucracies that ignore change and it is perceived as a means for resolving conflict rather than a vehicle for learning. In large, complex systems planning can act as an intervening variable between knowledge and action (Westley 1995). The ability to integrate knowledge into the planning process depends on the form of the scientific knowledge and the strength or dominance of the organization's paradigm that is informing the planning process. In other words, when planning is linear, scientific knowledge cannot be ambiguous, complex or subject to multiple interpretations. When the institution is rigid, information must match their process. Westley suggests that governments generally lack strong, unified ideologies that can support the incorporation of scientific information. At the same time, the lack of unified ideologies can inhibit implementation of clear actions.

Action is the combination of motivation to change and the availability of resources to do so (Westley 1995). Thus it is important to understand subcultures within institutions and their ability, or inability, to claim and control the distribution of resources. Action can occur without a formal decision when there are shared values and expectations lead to the action. However, there is a fine line between shared values omitting the need for a formal decision and a "decision through indecision" where actions are not consciously chosen yet a distinct path is followed. In the case of the latter, an unacceptable outcome can lead to the need to identify a "scapegoat" for the pseudo-decision. Thus, documentation becomes important to safeguard relationships.

When the required cohesive culture does not exist, considerable energy must be spent to make a choice of what to do. Planning can be used to reduce tensions and, at times, action becomes almost irrelevant. Formal planning assumes strategies will act as motivators for those who are to implement the decisions. However, the plans are often "bewildering, demotivating and alientating" (Westley 1995) to lower level staff. As the plans filter down through an institution, they can lose crucial nuances and understanding. This can result in staff either increasing their political activities (internal, external or both) or becoming increasingly rigid and bureaucratic in their behaviours.

An alternative to a reliance on formal planning processes is to recognize and integrate various modes of organizing to generate shared understandings and realistic actions (Table 4.3).

Is the notion of the four-phase cycle, including crises, inevitable? If so, then no one approach, even and AM one, should dominate for too long. Yet long-term institutions must manage the cycles rather than avoid and be destroyed by them. Westley (1995) suggests that the key is to avoid extremes in either order/structure or disorder/confusion. Perhaps if an organization is to survive and function well, then all modes or processes are needed, but none should dominate. Planning can not get too rigid, learning can not eliminate opportunities for coordinated action and visionaries can not operate completely outside of the institutional structures. What investments are required to do so and how will a forest company perceive those relative to the risks of reacting to the various phases of the cycle?

Table 4.3 Three forms of Organizing (Based on Westley, 1995)

	Defining the Issue	Action Mobilization	Resource Mobilization	Structuring
Planning Mode	"Public arena" dynamics, i.e. controversy, may force early closure of discussion used to frame the issue. Could result in oversimplifying the issue, partly because of insufficient data **Critical for planning mode.**	"Public arena" dynamics immobilize stakeholders. Participation in the necessary coalitions for cooperative action constrained by media depiction of the issues, soft support within the representative's home constituency, etc. Bureaucracies may perpetuate planning, not strengthen action.	Access to resources often secured in advance of defining the issue as allocation of resources to planning may be an institution's response to controversy.	Procedures/normal task allocations often limited to preexisting structures
Learning Mode e.g. social movements, community forums, scientific consortia	Issue is incrementally defined through individual initiative or negotiations. By the time the issue emerges, broad consensus has developed.	Commitment in advance of issue definition. Emerges from a groundswell of concern, which snowballs into action	Need to "piggy-back" on other institutions to mobilize. Resources may be co-opted in process because loose networks at disadvantage when collaborating with established organizations. **Critical for learning mode.**	Lack of resources may make structuring difficult. Often involves temporary coalitions
Vision Mode Key individuals and supporters	Visionary particularly skilled in issue definition process Use of symbols, emotionally evocative language	Link between affect and action fully utilized Intense personal commitment results in hunger for enactment	Creative resource mobilization Often avoid resources with too many strings, convince followers to divert personal and home organization resources to issue	Over dependence on visionary leader. Failure to institutionalize process or assure resource flow Burnout of committed individuals Need stable team capable of translating visions into structure **Critical for vision mode.**

4.6.8   Partnerships

The discussion thus far has largely focused on the dynamics, challenges and opportunities within an institution. The complexity of sustainable forest management requires that numerous organizations work together through various partnership arrangements. The current situation is what some might call chaos, where the notion of government agencies leading a process to address resource management issues is falling away. For example, some government managers consider the fact that there are more than 200 organizations involved with fisheries within the Columbia basin system to be a problem. Their frustration stems from the fact that they had participated in a previous era when a small number of government agencies could exercise their authority to make decisions. Some may feel that the current situation, where managers are required to work through complicated partnerships, has resulted in an inability to act decisively in order to do what is in the best interests for the fisheries resource. Yet during the era when a small number of government agencies had a greater degree of control, the numerous dams were built on the Columbia River system, which has set the stage for the current complexity of fisheries issues.

Gunderson et al. (1995) suggests that human systems of greater size and complexity have more management and institutional flexibility. This is not to say that it is easy to work within a large, complex system. There is need for considerable resources, both time and money, to be allocated to coordination and networking across the system. Yet, this complex arrangement may be necessary in order to address the inherent complexity in sustainable resource management. Olsson and Folke (2000) suggest looking at local institutions as being nested within a larger set of institutional arrangements, which is similar to local ecological issues that are nest within broader scale issues. The complex nesting of institutions may be necessary to span adaptively across the temporal and spatial scales that are such crucial elements of sustainable resource management. In order to span those scales, there is a need to fill gaps in the existing institutional flow of information. Non-governmental organizations can be one type of institution that helps to bridge those gaps as they work outside of the traditional constraints.

Simply adding information and organizations into the mix does not necessarily translate into an ability to grasp the complexity and devise creative, adaptive solutions. A large, complex system without clear understanding of how systems work, including what is required to move from defining a problem, to designing an approach and to implementation/monitoring/evaluation, can equate to stagnation, burn-out and a further erosion of trust in existing institutions. Previously, government initiated processes that were designed to bring together a broad cross-section of stakeholders to achieve consensus. Despite long and costly processes, some initiatives never reached consensus. Partly this was because of a divergence in expectations as to what consensus means. For some, consensus reflects broad agreement on the specifics of key decisions, thus requiring the decision-making process to be inclusive of all key stakeholders. For others, consensus is the building of trust and agreeing on the process decision-makers are to use, one that ensures individual decision-makers understand broad community interests and can and will act on that basis. Westley (1995) suggests that it may be better to have imperfect consensus, even conflict, in order to maintain a diversity of approach and flexibility in the system to explore options. This is necessary to maintain the overall resilience of the system. The implication is that a forest company's corporate identity, and internal consensus, can not be so strong that it detracts from the benefits of being part of broader networks.

In conclusion, it is being argued that complex partnership arrangements, with imperfect consensus and conflict, are necessary and, therefore, desirable in order to understand and respond to the complexity of ecological systems. In order to implement SFM, forest companies need to better understand, and be able to respond to, the complexity of ecological, social and economic systems. This suggests that complex partnership arrangements are in the best interest of forest companies. Whether or not that is true may be a moot point, as that is the current reality. So perhaps the most important question is what role(s) does a company need to, and can, play in such arrangements? Can a corporate interest lead a process when the pressures to meet

certification or government defined standards require them to demonstrate a better understanding of ecological systems and yet government is withdrawing from the leadership role? And if a forest company could lead such a process, should it? Corporate forestry interests are already addressing these questions through current operational decisions. These questions will also need to be assessed within the context of pursuing an AM approach to SFM.

5. Adaptive Management within a Corporate Forestry Context: Select Perspectives

As noted in section 2.0, informal interviews were conducted with knowledgeable AM professionals who are associated with a variety of forest companies. The interviews were used to explore particular barriers for using an AM approach for SFM and/or their general experience with AM.

5.2 Weyerhaeuser, BC Coastal Group

Weyerhaeuser, BC Coastal Group, developed an AM program that is part of the company's response to social pressures, via wide-spread market campaigns in the 1990's, to consider alternatives to clear-cutting of old growth forests (Coady 1999, Glen Dunsworth, Bill Beese, Nick Smith pers. comm.). While the impetus for change was initiated from parties that were external to the company, strong leadership from a new CEO was also a crucial factor. When the former MacMilllian Bloedel was taken over by Weyerhaeuser, the new CEO communicated a clear corporate vision that challenged staff to change company practices, while providing little direction for how to do so. The corporate vision included three challenges to staff:
- improve the safety record of the company
- address the social pressures and make the company "the most respected forest company in North America", and;
- make lots of money (Coady 1999).

Internal structures were created to address the challenges involved in realizing the corporate vision, including the creation of the "Forest Project". These structures internalized debate and led the company to adopt adaptive management as a means for helping to realize the corporate visions. The concept of adaptive management was discussed with the Board of Directors, although not the details of what is required to actually utilize AM (Dunsworth pers. comm.).

The work of the Forest Project led to the creation of an Adaptive Management Working Group and Variable Retention Working Group, among others. The internal teams linked with external sources of learning, for example research scientists at the University of British Columbia as well as establishing a technical panel of experts from various disciplines and perspectives. The company and its internal teams also linked with First Nations and communities via land use planning processes and other consultation efforts. The linkages with external perspectives, particularly gaining the backing of academics, was key in terms of building understanding, credibility and support for the work (Dunsworth pers. comm.).

However, the scientific panel could not always provide the clear answers that were required, for example in setting targets for which there were no ecological obsolutes. Hence, the internal teams needed to work with key Weyerhaeuser decision-makers to assess what was known about the ecological systems, as well as the social, economic and political contexts, in order to make the necessary decisions. The CEO who originated the corporate vision that embodied change has since left the company. The AM work has continued to be pursued by the working groups, with less direct involvement of senior decision-makers

Weyerhaeuser has relied heavily on Forest Renewal BC and, more recently, the Forest Investment Account (FIA) to fund a portion of the AM initiatives. Research and development tax credits on the corporate dollars that were invested were an important selling feature for senior management. The total investments have varied from upwards of $2 million to downwards of $500,000 per year, partly dependent on the FRBC or FIA contributions. The total investments related to what was once an annual cut of 5 million m3, but this has recently been reduced to approximately 3.5 million m3 based on government policy to take back a portion of the cut from licensees. With anticipated reductions in FIA funding and the fact that Weyerhaeuser, BC Coastal Group, lost money in 2003, concerns about continued funding for the AM initiative had staff speculating that partnerships and support from foundations may need to be sought (Dunsworth pers. comm.).

In March 2004, Weyerhaeuser initiated further changes to its corporate structure and eliminated the positions of key people who have been associated with the AM and Variable Retention Working Groups. At the time of writing this report, the impacts to Weyerhaeuser's AM program are unclear. One potential lesson to be learned from the Weyerhaeuser experience is the need for ongoing and direct communication between AM practitioners and senior decision-makers so as to ensure "success" is consistently defined, and supported, throughout the organization. On the other hand, the changes may be part of a larger corporate strategy that is not well understood at this time.

5.2 Plum Creek Timber Company, Inc., Seattle

Plum Creek Timber Company, Inc. is a publicly traded forest company that operates on private land in the Pacific northwest. Ten years ago, Plum Creek was faced with many challenges that culminated in the designation of the spotted owl as an endangered species under U.S. federal legislation (Lorin Hicks pers. comm.). As a result, it was felt that Plum Creek could no longer operate as they had done and so began to look at alternative methods of silviculture. They began to look at old methods but for new reasons, namely they were looking to leave more structure, not for economic reasons, but for ecological ones. This led Plum Creek on a path of experimentation at the corporate level. The social context, exemplified through federal legislation, challenged foresters to fit ecological concepts into economically viable applications. The company linked with universities, including commissioning a graduate student, to further the ideas of foresters. The result was an AM program involving numerous experiments being conducted simultaneously with research undertaken to support monitoring and evaluation.

Hicks suggested that AM has become part of Plum Creek's culture as a result of efforts to develop a habitat conservation plan for some of their private lands in the Cascades. The plan is a 50 year contract with the federal government to manage differently in order to gain some flexibility under the federal U.S. Endangered Species Act. It was suggested that development of the plan took experiments to another level – the landscape level. Corporate landowners crave regulatory predictability and, according to Hicks, that is why AM became way of doing business for Plum Creek. He believes that the pressures of the last 10 years have moved AM away from being a scientific game and made it a means of doing business. AM allows you to frame the uncertainty – how much money will you spend, what time frame will be required for decisions, how can we be pro-active?

It has been Plum Creek's experience that AM needs bounds, for example to be reasonably priced, and criteria to assess successful use of AM that supports:
• addressing specific uncertainties;
• demonstrating improvements, and;
• interactions with external interests (e.g. regulatory agencies, academics).

Although there is no formal corporate AM process, Plum Creek has an interdisciplinary team that has been together for over a decade. The internal team links with the required external interests,

including engaging specific experts and peer reviews, in order to write the plans. By getting senior people to sign-off the plans, they build internal support for AM. Through the budgeting process, specific commitments to monitoring and evaluation are identified. Monitoring and evaluation focus on core AM projects and the fast moving variables. Hicks suggested that to understand the slow moving variables likely requires a more collaborative approach.

The Cascade Habitat Conservation Plan cost over $1million to develop, with associated annual monitoring costs of $100-150,000. Prior to adoption of the plan, Plum Creek was spending more than $300,000 a year on spotted owl inventories and issues. Hicks suggests that the Habitat Conservation Plan gave predictability with less the ongoing costs being half of what was being spent on just one species. Additionally, development of the plan has resulted in new relationships with agencies and the public, which have allowed them to move forward. Plum Creek also anticipates that the monitoring costs will decrease over time, partly due to the cumulative lessons learned and that the area of land involved as been reduced through land exchanges.

There are two key lessons learned from Plum Creek's effort. Firstly, a corporate interest needs to understand AM in terms of demonstrated cost savings. Like Weyerhaeuser, the impetus for Plum Creek was social change that threatened the viability of its operations. Unlike Weyerhaeuser, the social context was manifested in legislation, which meant that Plum Creek had clearly defined rules it had to meet and the associated costs could be calculated and used to compare alternative strategies. Secondly, Plum Creek appears to have benefited from long standing relationships due to a stable internal core team of interdisciplinary perspectives. In order to avoid a narrowing of perspectives, the team links with external experts and interests to ensure new ideas are injected and considered.

5.3 CanFor, North Vancouver Island

CanFor has 10 forestry principles that were developed by a task force of Canfor staff, aided by a panel of outside experts. According to the CanFor website (www.canfor.com), "the Principles are based on the tenets of ecosystem management, continuous improvement, public involvement and third party verification of performance. Canfor views these Principles as a fundamental component in improving its existing sustainable forestry practices, ensuring the transparency of its operations and fulfilling registration requirements for eco-certification. The Principles were approved and subsequently introduced to all Canfor operations by the end of 1999". One of the ten forestry principles is for AM and states, "we will use adaptive management to continually improve forest ecosystem management. This will require the development and application of collaborative research and monitoring programs".

Following development of the forestry principles, there was discussion on identifying AM champions within CanFor regions as well as a corporate champion, but in the end this did not happen (John Deal pers. comm.). The forestry principles are broad statements of intent, which required refinement through regional plans in order to provide meaningful guidance. At this point, CanFor was in the midst of a merger and so some momentum may have been lost. Following the restructuring, there were limited resources and so support for AM became more dependent on the personal interest and motivations of the individuals involved. As it is mostly biologists who are leading the AM efforts, there is a stronger emphasis on understanding the ecological aspects of the issues. John Deal explained that, in his experience, at the coast there is a willingness to try new things and push to become more proactive. He feels there is support at both the regional and corporate levels, including Vice-Presidents, and there is the necessary feedback loops both internally and with senior CanFor people talking with government.

Particular concerns, such as species of concern (e.g. Goshawk, Marbled Murlettes) or riparian issues, have resulted in CanFor staff pursuing AM. The general approach is for CanFor to initiate a workshop with government staff to define the key questions that need to be addressed. The questions are then reflected in CanFor's SFM plans and in regional scale initiatives.

Based on the outcomes of the workshop, CanFor then works with government to design specific projects.

While CanFor is not allocating the kinds of resources to AM that Weyerhaeuser's BC Coastal Group has, it has committed $100,000 for monitoring ecosystem-based harvesting, $70,000 for monitoring Goshawk, $120,000 for Marbled Murlettes and $60,000 for basic planning regarding riparian issues. CanFor anticipates implementation of the resultant riparian plan will be double.

CanFor's AM efforts are not directly linked with any process to seek input from the public. However, John Deal does work with community representatives that are part of CanFor's public advisory group.

A key lesson learned from CanFor's use of AM is the importance of supporting individuals who are personally interested in, and motivated to use AM. This may be equally or more important than creating formal positions and processes. A potential down side is that the experience and skills of the committed individuals may result in a relatively narrow focus for AM. It would seem that, in the case of CanFor where the emphasis on ecological systems, there is a lack of complementary efforts to understand the social and economic systems rather than merely impacts in relationship to activities on the land base.

5.4 Slocan, MacKenzie Division

AM is used by Slocan, MacKenzie Division, as one approach to demonstrating continuous improvement in SFM (Scott McNay pers. Comm.). At the program-level, staff defines priorities based on an assessment of what is not working, including any difficulties they are having implementing decisions. According to McNay, to address such concerns, there is almost always an AM component.

A key example of their AM efforts is the caribou project, which is designed to answer questions about silvicultural regimes and any corresponding impacts to caribou habitats. The AM approach adheres to the BC Forest Service concept of AM, including use of conceptual models at the start with outcomes used to structure hypotheses and agreements with stakeholders. McNay suggests that the key is to link deliverables with the ability to develop, change and/or implement policy. bayesian belief networks have been used to understand uncertainty and risk as well as to express probability of occurrence and explicitly state relative confidence.

It was suggested that support for AM at the management level is a key to success. This observation seems to support a similar conclusion resulting from discussions with Weyerhaeuser, Plum Creek and CanFor staff.

5.5 Millar Western, Alberta

Millar Western is a forest company that is fully owned by the Millar family and has been for four generations. The family is sensitive to how the company is perceived and, therefore, is committed to demonstrating to government and the public that they are leaders in the field of responsible forest management (Johnathon Russell pers. comm.). Millar Western can not harvest enough wood from the lands they manage in order to support their mill. The cost of purchased wood from other sources is higher than that resulting from their own lands. The incremental cost difference has been used as a means of justifying the costs of developing a detailed forest management plan, which incorporates the principles of AM. Through the planning process, Millar Western identified an overall increase in their Annual Allowable Cut (AAC) as a result of intensive forest management on a portion of their lands. The resultant cost savings do not fully compensate for additional planning costs, but the family is supportive of absorbing some extra costs. Russell stated that long-term planning cost $.30/m3 with research, including monitoring, adding $1.00/

m3. He estimates that Millar Western has been able to identify $600,000 of savings per year, which has left a total additional cost of approximately .60/ m3 to be absorbed.

The planning process has incorporated AM principles in two ways. First, the company invested in understanding the natural state of the environment and then developed ranges of variation from the baseline. Human activities were assessed to determine potential implications for remaining within the desired ranges of variation. Cumulative impacts and mitigation options are also assessed. The second step was to examine Millar Western's forest management practices within larger processes, such as trends in human population (immigration and emigration), climate change and potential vegetation and wildlife responses, trends in oil and gas development, etc. Russell feels that government and society at large places constraints on what forest companies can look at with respect to calculating their AACs. Given that in Alberta forest companies are responsible for calculating AACs, Russell is seeking to engage the public in a discussion on the larger social-choice issues to determine what trajectory society wants to take, based on a better understanding of the issues. For example, Russell wants the public to understand that forest companies can invest in protecting grizzly bears, but if population trends continue, those investments may be wasted if the bears are negatively impacted by factors that are wholly unrelated to forest management.

The key lessons from Millar Western include the need to view AM as a set of principles that must be incorporated into planning and decision-making from the very start and throughout the processes. Additionally, while taking a systems-approach is a key component of AM, attempts to understand the social *system* implications, rather than just specific social impacts, in a manner to support the necessary dialogue is important but not well advanced.

5.6 Lessons from the Representation Test Case

The ongoing work regarding representation was used as a test case to explore the early thinking on AM of the authors of this report. On the one hand, forest companies must extract wood to meet market and shareholder demands for economic benefits with respect to the company, local communities and the province. At the same time, companies are required to maintain biological diversity as defined by international and national interests (e.g. as defined by certification standards), provincial legislation and policy as well as local concerns.

The concept of Old Growth Management Areas (OGMAs) was developed to address the need to maintain biological diversity for species associated with old growth attributes and to meet industry's need for certainty. However, some feel that OGMAs may constrain too much of the timber harvesting land base, the scale may not match with current SFM approaches for using criterion and indicators and the concept lacks clear intent as to how it will meet biodiversity objectives. To resolve the conundrum, industry is attempting to bring the ongoing research on the representation concept into an overall approach to SFM, which seeks to concurrently balance social, economic and ecological components at selected temporal and spatial scales. The research is resulting in published scientific rationales for representation, however such rationales are rarely a basis for decision-making as there is a need to "bring the research down to the ground". New data is being produced and efforts are being made around the province to explore how the data and the research can be applied. The question that was explored through a workshop with industry and government representatives was, would AM be an effective vehicle for making the transition from research concepts to applied management decisions? The hypothesis that was explored through the workshop was that clarifying uncertainties and risk helps to define what needs to be learned. The resultant learning objectives could then be used to define what, if any, AM approach would be appropriate.

The key conclusions from the workshop included:

1. Collectively identifying key questions was useful in understanding not only the list of inherent uncertainties but also the relationships between them. Participants posed questions that the workshop facilitators later translated into positive statements or learning objectives to reflect what could be pursued. Learning objectives were then grouped or nested based on:

    - Economic, social and ecological considerations
    - Strategic, tactical and operational needs
    - Spatial and temporal scales
    - Decision-making, rational planning and emotional motivations to act
    - The six steps of AM: assessment, design, implementation, monitoring, evaluation and adaptation
    - Research, management and communities

    The learning objectives were assessed to determine which category they best fit within and then to determine what corresponding learning objectives might need to be addressed in related categories. For example, if a learning objective most closely reflected concerns about tactical level planning, then corresponding learning objectives for the strategic and operational levels were also formulated. Once the learning objectives were located by category, linkages between the layers could then be identified and priority learning objectives defined. A basic attempt to do so was conducted in association with the workshop.

    The resultant key learning objectives were then discussed with workshop participants relative to various learning strategies or approaches to AM (see sections 3.1 – 3.4). While some industry representatives originally supported the concept of parallel or sequential learning in relation to representation, their reasons for doing so were because they had hoped an AM approach would resolve a wood supply issue. A review of what is involved in AM, namely a commitment to learning and experimentation, which may or may not result in resolving a wood supply issue in a manner that is traditionally deemed a "success", caused them to reconsider and look at what incremental steps might be possible.

    The implications for using AM as a foundation for SFM include that a comprehensive approach by a corporate forestry interest is required. A systematic AM assessment would define the relationships between short-term crises and realistic responses that can build the resiliency of the company as is required for SFM. The inherent difficulty is publicly recognizing what might be required to get the company to a point where it could be resilient. A comprehensive approach is also needed to ensure that the corporation can provide clear, unambiguous direction to staff, who must meet requirements for SFM as well as address short-term wood supply issues. Additionally, while most workshop participants acknowledged the need to assess how best to proceed with the representation work, some were frustrated by the process of assessing potential learning strategies as it felt too "esoteric" for them. However, the initial support for AM that was expressed by some industry people only to be abandoned when they explored it in more detail suggests that creating a common and solid understanding of AM is important. Finally, to even consider AM at the project-level requires that AM principles have been used at every step of the planning process in order to ensure the necessary context has been addressed.

2. As suggested in the literature, there is a strong need to redefine the relationships between research scientists and resource managers. The representation workshop illuminated the need to do so from the very start. Academics at the University of British Columbia (UBC) had been pursuing the representation concept with little input from front-line forest managers. While the companies have been aware of the research at some level, the integration between research scientists and resource managers required more active and direct communications. This has been addressed to some extent subsequent to the workshop. A representative of UBC has met with Slocan and Tembec several times in order to starte integrating the concepts of representation into learning objectives through spatial forecasting (Ralph Wells pers. comm.).

3. The questions and learning objectives that created the greatest discussion and frustration related to decision-making and the associated categories of rationale planning and emotional motivations to act. The relationships between government agencies and forest companies in British Columbia are in transition, with industry being assigned a greater stewardship role. Industry has grown accustomed to government assuming the leadership role in initiatives that require multiple stakeholders dealing with management of Crown lands. However, a major motivating force for pursuing the representation concept is for industry to meet certification standards and/or to present a case for sustainability as one indicator that has to be integrated with others and balanced so as to respond to market campaigns. Government agencies do not have a mandate relative to certification standards, which are developed by independent organizations. Hence, industry is, by default, in the leadership position. Examination of the questions and learning objectives associated with decision-making identified that a lack of leadership, and therefore a lack of communication and coordination, is a significant barrier to moving forward.

   The implication for an AM framework to be used by a forest company that the approach must be sufficiently transparent so that it can be effectively communicated to a variety of potential partners. Additionally, use of the AM approach needs to meet the requirements of due diligence so that efforts that are initiated by industry have a greater likelihood of receiving support from government agencies, which may not be fully engaged as they move to a compliance and monitoring role.

6. Implications for a Select Corporate Forestry Context

Clearly AM is not a panacea, otherwise there would be fewer references in the literature as to the barriers for successful implementation and more "successful" examples found through case studies. Halbert (1993) suggests that some basic questions need to be asked about AM, including:

1. Given that AM is so hard to implement, is it the best way to manage resources? Or even an appropriate technique?
2. Can uncertainty be resolved experimentally?
3. Is the learning time short enough to be effective before the resultant information becomes outdated?
Will natural resource managers be willing to act on the science and resultant information? Or will other agendas over ride, thus reducing science to a delay tactic?

A broad definition of AM, as outlined in section 3, seems appropriate for corporate forestry interests in order to retain flexibility in responding to the inevitable variations in issues, regulatory (government as well as certification) requirements and stakeholder needs. A solid understanding of both the opportunities and limitations associated with AM needs to exist throughout the company in order to critically assess any given situation and determine what, if any, AM approach might be appropriate. However, beyond building an understanding of AM, corporations must also create and maintain the required adaptive culture within their organization.

The following sections outline a comprehensive AM framework for a select forestry context, which involves a large corporate company with numerous divisions and a relatively small head office structure. The assumption is that the company has a lean corporate structure and, therefore, draws on external contracted expertise as required. Application of the proposed AM framework to other contexts would likely require modifications.

6.1 Rationale for Adaptive Management within a Corporate Forestry Context

AM is a way of doing business that makes money, saves money and reduces risks by:

1. *Serving as the vehicle for realizing corporate goals, which challenge the organization by requiring change and innovation. This is often necessary to ensure the corporation is aligned with evolving social goals, which define market opportunities and barriers.* For example, AM can serve as the mobilizing force for implementing SFM. It defines the required corporate culture and processes for maintaining an effective and creative tension within the corporation between short-term profit goals and long-term maintenance of options. As such, AM is used to determine if and how investments in implementing the framework result in a net gain.

2. *Ensuring that the corporation meets requirements for continual improvement under certification processes in a cost-effective manner.* AM provides a clear and consistent approach for demonstrating continual improvement, which can be effectively communicated.

3. *Acquiring the knowledge that is needed sooner than the current practice of muddling through, which is essential to operate efficiently in a results-based regulatory environment.* The pace of decision-making is increasing, yet forest managers face a high degree of complexity and uncertainty. AM uses structured learning processes to ensure the resultant information is of high quality, applicable and attained in a relatively short time frame.

4. *Providing the necessary bases for seeking change to policies or practices and encouraging innovation that is required to achieve corporate goals.* Efforts to implement innovative practices can meet with resistance. While it is not possible to institutionalize innovation, it is possible to establish a credible and transparent process for developing and selecting options so that others, including key decision-makers, can understand the approach and rationale. Although not a guarantee, demonstrating due diligence is an important component for success.

5. *Providing a competitive advantage by ensuring the organization as a whole is engaged in assessing uncertainties, as well as the range of potential responses.* As one forester stated, "we are good at being reactive. What AM will do is move us to be proactive". Additionally, through better documentation that accompanies structured learning processes, a corporation can realize efficiencies by better understanding how the lessons learned in one situation can be extrapolated to other applications.

6. *Enabling the corporation to engage in new business relationships that are necessary in this era.* Forestry companies themselves are complex organizations. The fact that such corporations operate within a network of industry interests, government agencies, First Nations and community stakeholders compounds the complexity. A corporate approach to AM needs to provide the basis to understand complex systems and how they fit together. This facilitates communication with other professionals and community groups and helps clarify opportunities, roles and responsibilities for the corporation.

7. *Strengthening existing planning and decision-making processes.* "At first glance it looks like a lot of work, but in reality we are already asking ourselves these questions" – a forester. The difference is that the AM program helps everyone understand how the questions fit together and how such efforts lead to what can be done in order to move forward in the face of the complexity and uncertainty.

6.2 Comprehensive Corporate Approach to Adaptive Management

A comprehensive approach to AM is required that includes:

- *Corporate strategies* - policies and procedures necessary to develop and maintain an adaptive culture. This relates to all levels and structures with the corporation, as well as the relationships between.

- *Program level guidance* - how AM principles can be incorporated into strategic, tactical and operational planning processes to create the necessary context for successful use of AM at the project-level. AM as a foundation for implementing a SFM framework and defining linkages between a corporation's SFM program and CSA certification process are examples of program-level AM.

- *Project level assessment* – a means to assess opportunities/benefits/costs for utilizing various AM approaches on a project-by-project basis.

6.2.1   Principles for a Corporate Culture to Support Adaptive Management

AM requires *clear, tangible and consistent support from senior management* for:

1. *Creating and maintaining an effective creative tension between the short-term profit goals and longer-term need to maintain options.* Corporate leaders need to communicate visions that meet this intent and are unambiguous, while avoiding prescriptions on how to achieve them. This results in the organization galvanizing around a common purpose, while encouraging debate and innovation to achieve the vision. Senior management must be engaged at key stages in the process for defining how the vision can be realized, as well as throughout implementation, while avoiding micro-managing their staff. When these conditions are met, organizations are capable of addressing challenges in ways that are highly innovative and productive.

   In order to galvanize the organization, the vision needs to reflect a noble cause that connects the corporation with broader social goals. Thus, while the corporation is aligned to achieve the corporate vision, staff feels empowered to examine the needs of the corporation along side those of the communities in which they belong. For front-line staff, there must be avenues to consider how corporate strategies relate to the needs of the local communities in which they live. At the higher levels, staff is encouraged to network, including with professionals employed by competitors, to understand how broader social goals are playing out at various scales. Hence, there is no clear path to achieve the vision. Rather, a creative tension develops within the organization. Having the right people, internal structures and processes in place is essential to integrating the various perspectives and assessing multiple, integrated paths at various scales that can move the company from the current situation towards the defined vision.

   Ambiguous visions can result in costly gridlock within the organization. For example, if senior management communicates a vision that addresses the long-term needs of the company, yet incentives, such as bonuses, are limited to supporting short-term profit goals, then the corporation can not effectively align to meet any corporate goal. In such a situation, the internal conflict must be seen as a waste of resources. Alternatively, if the means to achieve SFM are too narrowly defined and merely supplants the status quo with a different set of standard practices, then opportunities for innovation and the resultant competitive advantage will be lost. In other words, a lack of internal creative tension will result in a wasted effort. General approaches to achieving the corporate vision must be rigorously debated, with staff encouraged to propose alternatives, implement approaches that may be somewhat different

than counterparts in other aspects of the organization and to assume a high degree of ownership for how to realize the vision.

If the involvement of senior management ends at communicating the vision and they lose touch with what is being learned through efforts to define and implement approaches for realizing the vision, then they may perceive failure and simply move to define a new corporate vision. While it is beneficial to occasionally challenge the organization to avoid a narrowing of thinking and practices that can compromise the longer-term viability of the corporation, repeatedly initiating major course changes is costly. Rather, a well-conceived corporate vision that challenges an organization should remain viable for a significant period of time. By having senior management re-engage at critical points, the new knowledge will not only move up through the organization, but senior management can respond in a manner that continues to positively challenging the organization within the context of the overall vision. Senior managers can also ensure the diversity of approaches being used is complementary and, in fact, the organization continues to be generally aligned in its efforts to attain the vision. If a subsequent change in the vision is desired, it will then be based on a solid understanding of what was gained in the development and implementation of approaches used to realize the previous one. If, however, senior management tightly controls the process, then the practical experiences of front-line staff may fail to be reflected, thus the end result may prove to be ineffective.

2. *Investing in long-term relationship building with external interests to maintain opportunities for collaboration and effective consultation.* This is necessary given the complexity of the issues, as well as the need to participate in management decisions that transcend the boundaries of the corporation's management units. The mechanisms for relationship building need to be diverse, as opposed to locking into a standard, formal process. Informal networking is needed to understand the views of influential people who may, for various reasons, not participate in such formal processes.

3. *Acknowledging that change is inevitable and that it is good business to invest in understanding the root causes of impending change.* Proactively responding to change is desirable in order to maintain the ability to adapt and prevent major crises. To do so requires identifying "leverage points", which often exist in a part of a system that is distant from where the symptoms are being manifested. As a result, it can take time between implementing an action and achieving the desired results due to the distance. Defining appropriate actions requires investing resources into understanding and addressing the slow moving variables to reduce the tendency of the fast moving variables to push the corporation into crisis management. The long-term investments in understanding slow moving variables likely requires a corporate interest to seek partners with organizations that have a long-term mandate with respect to such issues. Implicit in this is that the internal corporate structures are designed to be actively seek the leverage points and be adaptable in pursuing them, thus supporting the implementation of AM as a way of doing business so that the corporate entity remains viable and resilient.

4. *Defining success as gaining new knowledge that clarifies if selected options are practical and effective for any given issue.* This is in contrast to defining success as achieving a set goal. Learning what options are ineffectual at meeting the goal, or if the goal itself needs to be changed, is an equally valuable commodity as the cost-savings to the organization can be significant. When knowledge is considered a valuable commodity, the corporation needs to be structured in a manner that best captures, develops, and retains knowledge.

5. *Ensuring that, internally within the corporation, innovative ideas can be introduced through means other than narrowly defined standard operating procedures and strict hierarchical decision-making processes.* This may be necessary to overcome barriers that could compromise broader corporate goals.

6. *Implementing a human resources policy that supports an adaptive culture.* Hiring practices and when and how to use consultants are considered relative to the corporation's need for strategic thinking, effective corporate visions, flexible management structures, encouragement of new ideas and maintenance of corporate memory.

6.2.2. Corporate Level Strategies

To be effective, a highly placed member of the corporate office team must have responsibility for championing the use of AM to achieve complex corporate goals. The staff person must have direct access to the corporation's Executive, but with an ability to work directly with Regional/Divisional/front-line staff as required. Additionally, the staff person must have adequate resources to serve as effective support for others within the organization to solve complex problems. Based on the experience of other corporations, merely creating an AM working group has proven to be insufficient.

Therefore, it is recommended that a senior position be created, Executive Director of Strategic Operations, at the corporate level to champion the use of AM for meeting corporate goals that challenge the status quo of the organization.

Qualifications
The Executive Director needs to be highly knowledgeable about AM. To successfully implement a comprehensive AM program at the various levels, the Executive Director will need to combine their AM knowledge with experience in:
- Understanding and applying systems theory to corporate management and forestry
- General business and management practices
- Market campaign, certification and management responses like SFM
- Information management issues and options
- Project management
- Strategic planning and strategy development
- Networking with professionals across a diverse range of agencies, corporations and organizations
- Consultation with First Nations and community interests
- Communication and training strategies, with respect to capturing and disseminating knowledge within and beyond a corporate organization

The Executive Director need not be a visionary, rather the Executive Director assists other managers and staff to network with internal and external visionaries so that the ownership of the resultant visions will be shared by others in the company. Once the vision has been defined, the Executive Director serves as key support for realizing the shared vision. While a primary function is to use creativity to prepare the company for change, it would also be beneficial for the Executive Director to be a catalyst or have access to catalysts. Catalysts are defined as people who use new approaches and ideas to develop understanding of a system and evolve alternative policies to explore possible futures.

Formal Reporting and Relationships within the Corporation
It is recommended that the Executive Director report directly to the senior manager of operations, likely a Vice-President of Operations, with a formal communication requirement to directly update and seek input from the Chief Forester and Managers at the regional/divisional levels. However, it is recognized that personal interest in AM is equally important to position. Hence, an alternative reporting arrangement may be desirable to ensure that key members of the Executive have direct access to information that is necessary to develop and communicate clear, tangible and consistent support for AM at all levels within the company.

The Executive Director builds teams to use an AM approach for addressing specific uncertainties related to a stated corporate vision on an as-needs basis. For complex issues, a multi-disciplinary team will likely be required. A flexible use of the team approach will likely involve teams operating at various scales throughout the organization. In some cases, teams may be tasked with the complete process, including assessment, design, implementation, monitoring, evaluation and adjustment, with senior management engaging at key stages. In other situations, teams may be formed to conduct assessments and then re-configured to pursue design or other phases. The key is for the team to be given a clear mandate with reporting/communication requirements to Regions/Divisions and the Corporate level also clearly defined. It may be desirable to have some overlap in the mandates of two teams to encourage diversity in thinking and serve as a check-and-balance. For example, two teams from different parts of the company could be asked to pursue similar questions in isolation of each other. The team works to a set timeline, with extensions being rare. Rather, a follow-up mandate may be endorsed based on a review of the progress made in the first phase and consideration relative to evolving priorities.

Responsibilities
The Executive Director of Strategic Operations utilizes and coordinates the flexible team approach so as to:

- ensure a comprehensive and nested list of questions is identified, that are considered important to maintaining an effective creative tension between the corporation's short- and longer-term goals and to meeting any other stated corporate visions. The list of questions is reviewed and prioritized by the Executive, based on criteria proposed by the Executive Director. The criteria may be peer reviewed by people within and external to the company. As the list will continue to evolve, at reasonable intervals the priorities will be reviewed and the decision-making criteria updated as required.

- promote creativity in the design phase and ensure that design aspects relative to various scales are understood. In working with the teams to design options for achieving the corporate vision, the Executive Director develops a solid understanding of the inherent uncertainties and risks to be communicated and understood by the Executive and others within the organization.

- seek the most cost effective approach to implementation through effective communication across Regions/Divisions and with the Corporate office. The goal is to ensure lessons learned in one area can benefit implementation efforts in other areas.

- develop an integrated and cost-effective monitoring program at the corporate level, which encompasses monitoring at all levels within the organization. As no one project is likely to provide all the necessary knowledge, the Executive Director serves as an overseer to determine how a suite of projects, being pursued at a variety of scales, can be used to generate highly relevant information.

- utilize a rigorous evaluation process, which benefits from both quantitative and qualitative methodologies. Thus, information gained through monitoring is translated into meaningful knowledge by combining it with the experiences, values, training and intuitive thinking of the appropriate people based on the questions to be addressed. The Executive Director can, therefore, ensure that the Executive has the necessary context in which to consider the results of efforts to realize the corporate visions.

- define and assess potential adjustments in approaches to realize a corporate vision, or in the vision itself.

It is anticipated that the Executive Director will serve as liaison to the teams, however it may be necessary to actually participate in or chair one or more teams, depending on the subject matter and abilities of other team members.

The Executive Director will also be responsible for overseeing a system to collate, archive, track and extend the information and knowledge gained through the associated processes and projects. Extension will involve firstly training people in AM in order to ensure effective participation in the processes. Secondly, the Executive Director will need to design processes for

communicating and consulting on the information and knowledge that results from utilizing AM as a means of doing business.

Resourcing
Given the emphasis on challenging the corporation to identify and pursue innovation, it is recommended that a corporation use research and development tax credits to fund the salary for the Executive Director and provide seed money for the AM program for a minimum of two years. The Executive Director would then work with front-line staff to identify their ideas that could make or save their office money. On completion of such projects, the Regional/Divisional offices are able to keep a portion of the money made or be rewarded for the money saved, with a portion going to support the future efforts of the Executive Director of Strategic Operations. The Executive Director leverages these sources of money to access project-based funding from governments, partnerships with other corporate or stakeholder interests, etc.

6.2.3   Division/Regional Level Strategies

As discussed above, the Executive Director for Strategic Operations has a formal communication relationship with Regional/Divisional Managers. It is assumed that many of the ideas to be pursued through a team approach will be generated by front-line staff and, therefore, Region/Division staff will participate on teams as appropriate. However, to effectively utilize AM, front-line staff will require support.

It is not possible for front-line staff to implement AM "off the side of their desks". At least initially, such staff will need to invest time in learning about AM, networking to clarify all the related initiatives that are being pursued by potential partners and to undertake a credible job for the assessment and design phases. Additionally, a corporation needs to invest in building and maintaining its corporate memory so that future investments benefit from past experiences. Corporate memory involves more than a commitment to written documentation of lessons learned, rather explicit efforts are required to share the resultant *knowledge* (as opposed to sharing information).

Therefore, it is recommended that corporations use rotating sabbatical opportunities for front-line staff to inject innovation, while building or maintaining corporate memory and communication. Opportunities for sabbaticals could be offered to Region/Division level staff to pursue high priority issues and questions. The sabbatical would be a special time-limited opportunity to step out of their regular position so they can conduct the detailed assessments and network with experts. This would lead to designing a solid and innovative approach to addressing questions that have been identified relative to uncertainties in achieving the stated corporate vision. When the sabbatical is over, the Region/Division person returns to their original position and implements the projects as part of that position.

The sabbaticals would be awarded based on a review of proposals developed by Region/Division staff. The proposals must include a business case for how the project is anticipated to make money, save money and/or reduce risk to the corporation, thus positively contributing to the creative tension between the short- and longer-term corporate goals. The proposals would be submitted to the Executive Director for Strategic Operations and reviewed by a team of corporate and Region/Division staff members, with the potential to include outside experts on the review panel.

The most desirable means of back filling for the Region/Division staff while they are on sabbatical would be for a corporate staff person to be hired for this purpose. While back filling the divisional position, the corporate person would report to a supervisor within the region/division related to the tasks that are being performed. However, the person would also maintain an overall reporting relationship to the Executive Director for Strategic Operations. When the sabbatical has been completed, the corporate person has a transition period of working directly for the Executive

Director before moving to another division to backfill for another sabbatical. This option would result in strong communication linkages both laterally and vertically throughout the organization. Hence, this option would be highly effective in building corporate memory, which is essential for long-term efficiencies within the organization.

Back filling the Region/Division staff member with a consultant or another Region/Division person would not achieve all of the same goals, although such an approach may be easier to implement. It is also possible to have the assessment and design work done by external consultants, with Region/Division staff providing direction. However, this approach is far less effective in developing the corporation's internal capacity for AM. Additionally, reliance on consultants is only effective if sufficient time is allocated to work closely with them in order to understand the contextual details of their recommendations. A failure to allocate sufficient time results in building the capacity of consultants and increasing the company's reliance on them. However, if there is a lack of interest or needed skills at the Region/Division level, yet there is an urgent need to pursue an AM project, the use of consultants may be a necessary measure.

6.2.4 Staff Level Strategies

Performance Measures

It is recommended that corporations define performance measures for individual staff and programs to reflect the need to use innovation to achieve an effective balance and creative tension between short-term profit goals and longer-term maintenance of options. This is particularly important for the Vice-President of Operations, the Chief Forester, Regional/Divisional Managers and Planning Foresters throughout the organization so they have a vested interest in working with the Executive Director of Strategic Operations as an effective team.

While other organizations have considered identifying AM champions at both the corporate and Region/Division levels, this approach is not recommended. AM is a process to achieve goals, not a goal in and of itself. Additionally, it would be ineffective to simply identify one person at the corporate level with a corresponding individual within each Region/Division. Rather if AM is to become a way of doing business, responsibility for doing so must exist widely throughout the organization. Performance measures need to address the goal(s) which AM is to be used to achieve, with the internal structures designed to make it easier and/or more desirable to use AM than not to.

Rewards and Incentives Program

It is recommended that a rewards and incentives program be instituted that recognizes the necessity of the creative tension between short- and longer-term goals. This could include incentives and rewards for staff to develop innovative project proposals to meet complex corporate goals, managers to implement innovative and flexible structures and decision-making processes that encourage innovation, etc.

6.2.5 Program and Project-Level Strategies

As noted earlier, using AM as the mobilizing force for implementing SFM is one example of program-level AM. A compendium to this report, entitled *Adaptive Management: A Guide for using Adaptive Management within the context of Sustainable Forest Management* (Scott-May and Field 2004), has been developed as a tool for the Executive Director, and others trained in AM, to guide planning at the strategic, tactical and operational levels. As a result, the AM Guide can be used to:

- develop a SFM plan;
- review and revise an existing SFM plan;
- develop an overarching SFM plan at the corporate level;

- develop operational projects that utilize AM;
- etc.

The key is to ensure that planning is not reduced to the point where meaning and opportunities for innovation are lost. Hence, it may be desirable to have all aspects of the company develop SFM plans simultaneously in order to avoid the "cookie cutter" approach whereby the last plan is essentially a regurgitation of earlier efforts. However, there are advantages to learning from the efforts of others. The key is for front-line staff to be effectively engaged in the process and required, via their performance measures, to develop a visionary plan that aggressively explores options for maintaining an effective balance between the short- and longer-term corporate goals.

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