

PROFILE

Integrated Environmental Management: The Foundations for Successful Practice

RICHARD D. MARGERUM

School of Planning, Landscape Architecture and Surveying
Queensland University of Technology
GPO Box 2434
Brisbane, Queensland 4001, Australia

ABSTRACT / Integrated environmental management (IEM) is a holistic and goal-oriented approach to environmental management that addresses interconnections through a strategic approach. Although no models of IEM have emerged, practitioners throughout the world are forging ahead with the concept. The literature indicates that stakeholder collaboration and public involvement are central to operationalizing

this model, because this interaction produces a more integrated approach and generates support for implementation. However, it is not clear what steps and conditions are necessary for successful translation of IEM into operation. The author draws on twenty-three case studies from the United States and Australia, a survey of 285 Australian stakeholders and the literature to produce a framework for IEM. The framework identifies 20 elements that—if attained—will increase the likelihood of successful operationalization of IEM. These elements address structuring of an integrated approach, operation of stakeholder processes, and outputs and outcomes. The elements do not constitute a formula for success, but a generic set of attributes that constitute a foundation for effective practice.

Each month in the Australian state of Queensland, members of the Johnstone River Catchment Management Committee (CMC) meet to coordinate the implementation of their catchment strategy. The Johnstone CMC includes representatives from sugarcane farming, grazing (ranching), tropical fruit industry, environmental groups, state agencies, and local government. Since its formation in 1991, the committee has produced a management plan, improved communication between stakeholders and produced best-practice standards in cooperation with industry and agriculture. In Wisconsin (United States), staff with the Department of Natural Resources have worked cooperatively since 1986 with federal agencies, state agencies, local government, and citizens to implement the Lake Winnebago Comprehensive Management Plan. The plan identifies management actions to address a range of problems on the Winnebago system, and approximately 75% of the actions are underway or completed. These actions include a habitat restoration program that will restore up to five miles of marsh and shallow-water plant communities, several terrestrial habitat restoration projects, and the initiation of four subwatershed non-point source control projects.

The Johnstone and Winnebago approaches, which were both researched by the author, are examples of integrated environmental management in action. A diverse group of stakeholders comes together, shares

information and perspectives, fosters mutual understanding, and develops a collaborative approach to managing an environmental system. Integrated environmental management (IEM) is one of several terms describing regional, holistic approaches to environmental decision making; similar terms include ecosystem management, integrated resources management, integrated catchment management, and watershed management. The author uses the term integrated environmental management to refer to this array of integrated management concepts because it is the most inclusive term.

Integrated environmental management is being advocated in many countries throughout the world. In the United States, state agencies and regional bodies are taking an integrated approach to manage watersheds, forest systems, and plan for regional growth (Clark and others 1991, Innes and others 1994, River Federation 1994, US EPA 1993). In Canada, provincial governments have initiated integrated watershed and basin management efforts (Dodge and Biette 1992, Shrubsole 1990). In Australia, the states of New South Wales, Victoria, Queensland, and Western Australia have policies or legislation to integrate management across watersheds (or catchments) (AACM and Centre for Water Policy Research 1995, Burton 1992, Mitchell and Hollick 1993).

What Is IEM?

Integrated environmental management is based on the concept that environmental regions—whether defined by the boundaries of catchments, bioregions, or

KEY WORDS: Integrated environmental management; Stakeholder collaboration; Ecosystem management

other criteria—need to be managed holistically. Born and Sonzogni (1995, p. 168) state, “IEM is a response to much of traditional natural resource management, which has been largely reactive, disjointed, and for narrow or limited purposes.” A recent review of the literature on IEM revealed four substantive elements (Margerum and Born 1995). It is a holistic approach, considering the entire system rather than certain elements of subcomponents (Slocombe 1993, Thomas and others 1988). IEM also acknowledges interconnections in both the physical and human systems (Johnson and Agee 1988, Moote and others 1994). Many authors also emphasize that IEM is goal-oriented or focused on end points (Grumbine 1994, Mitchell 1990, Moote and others 1994). Finally, IEM must be strategic, which includes focusing analysis early and biasing planning toward implementing actions (Born and Sonzogni 1995, Lang 1986a).

How Is IEM Operationalized?

While there is considerable discussion about the substance of IEM (what it is), there has been less elaboration of its operationalization (how it is put into practice). Mitchell and Hollick (1993, p. 737) note, “Intuitively, most people can relate to the basic idea [of IEM], but it is difficult to translate it into operational terms.”

Several authors emphasize the role of interaction and coordination in IEM (Born and Sonzogni 1995, Burton 1991, Gilbert 1988, Slocombe 1993). Mitchell (1986, p. 17) notes that the ideas associated with IEM are “the sharing and coordination of the values and inputs of a broad range of agencies, publics and other interests when conceiving, designing and implementing policies, programs and projects.” Margerum and Born (1995, p. 377) suggest that interaction is not just an important part of IEM, it is “the key operational component.” They identify two forms of interaction: stakeholder collaboration and participation by the general public. Stakeholders are individuals with an interest in the system being addressed; they can include landowners, concerned citizens, representatives of citizen groups, local government, and state or federal agencies (Gray 1989, Pasquero 1991). The general public also has a stake in the system—although often less well-defined. They are often not involved in day-to-day decision making, but their perspectives and views must also be considered to build a broader consensus (Daniels and Walker 1996).

The interaction among stakeholders and the public input has two effects. First, the process helps achieve the substantive objectives of IEM by including a diverse

array of information, knowledge, and perspectives (Grumbine 1994, Slocombe 1993). Second, it can produce networks, social capital, and political will, which are necessary to put an integrated approach into operation (Innes and others 1994, Mitchell and Hollick 1993). Thus, at its core the operationalization of IEM involves a stakeholder group, its relationship with the array of government and nongovernment decision makers, and its relationship with the public. Therefore, the critical questions are: How are these stakeholder groups initiated? How do they operate in conjunction with stakeholding organizations and the public to devise an integrated strategy of action? What do they need to produce to successfully implement a more integrated approach?

This article aims to advance the practice of IEM by presenting a set of elements that appear to be critical for the successful initiation, operation, and implementation of IEM. These critical elements are the foundations for successful practice. They do not constitute a model, but by synthesizing these findings the author hopes that a clearer model for practice will begin to emerge.

Methodology

Two sets of case study investigations and a participant survey are the basis for the findings presented in this paper (Figure 1). A case study approach is the primary source of information, because it is best able to capture the richness of individual settings that are too complex to be studied solely through surveys or experimental strategies (Yin 1989). All of the case studies examined for this article met the criteria of IEM described above. The author used survey data and secondary research to analyze specific issues of some elements, although the interconnectedness of many elements makes isolated assessment difficult.

In 1993, the author conducted an exploratory investigation of eight IEM case studies in the United States, interviewing almost 100 case participants (Table 1). Besides meeting the criteria of an IEM approach, the case studies were chosen because participants had achieved some degree of implementation success. The research identified a set of common elements among the cases that appeared to be necessary to translate the concept into operation.

In 1995, these elements were compared to the Australian experience using 15 case studies in New South Wales, Queensland, Victoria, and South Australia. All of the case studies met the criteria of IEM, but unlike the US cases, the author chose the Australian cases largely at random. The degree of operational success varied considerably among the committees,

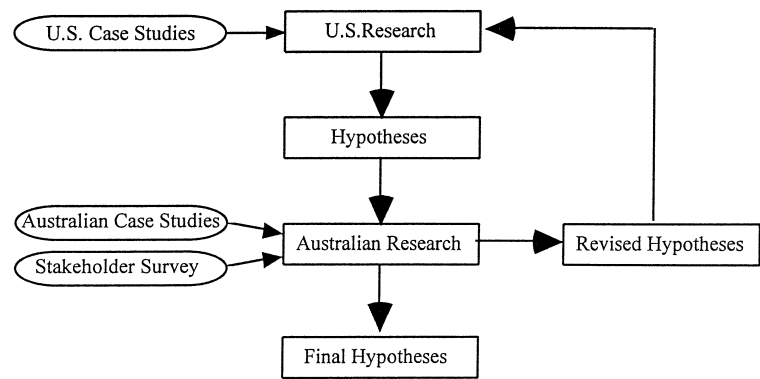


Figure 1. Research methodology.

Table 1. Case studies

Case studies	Location
United States	
Starkweather Creek	Wisconsin
Milwaukee River	Wisconsin
Upper Wisconsin River	Wisconsin
Lower Wisconsin River Valley	Wisconsin
Winnebago System	Wisconsin
Black Earth Creek	Wisconsin
Upper Mississippi River	Upper Midwest
Lake Tahoe Region	California-Nevada
Australia	
North West Region	New South Wales
Clarence River	New South Wales
Georges River	New South Wales
Hacking River	New South Wales
Illawarra Region	New South Wales
Lockyer River	Queensland
Condamine River	Queensland
Mary River	Queensland
Pioneer River	Queensland
Johnstone River	Queensland
Trinity Inlet	Queensland
Goulburn-Broken Region	Victoria
Corangamite Region	Victoria
North East Region	Victoria
Mount Lofty Ranges	South Australia

allowing the researcher to test and refine the elements by comparing the committees.

Evaluations of operational success were based on qualitative and quantitative assessments of outputs (plans, products, projects, and policies) and intangible outcomes (trust, networks, mutual understanding, alliances).¹ The author used three sources of data for these evaluations: stakeholder assessments of their own suc-

cess (from interviews), researcher assessment (from interviews, attendance at meetings, and review of products), and third-party assessments of performance (consultant reports, research reports, and theses). On the basis of these data, the author classified each committee into one of three categories of performance: above average, average, and below average. These assessments were compared to the elements to evaluate their inclusion, refine them, and identify new elements. Due to the complexity of the variables, both individually and as a whole, identifying these elements is not a pure science, but an iterative process of identification, testing, and exploration.

In addition to the case studies, the author surveyed 550 Australian catchment committee participants to examine specific issues (response rate: 52% or 285 responses; respondents: 54% from New South Wales; 46% from Queensland). Thirty-one percent of respondents represented organizations such as government agencies, local government, industry, and formally organized interest groups, while the remaining 69% indicated no formal representation. The survey queried participants about accomplishments, process, and outcomes using a Likert-type scale to measure responses. One of the questions asked respondents to agree or disagree with the statement, "Our committee has accomplished a lot." The wording was intentionally broad to allow respondents to use their own definition accomplishment. Using mean assessments of accomplishment, the researcher divided the committees into four groups (Figure 2).² The author's rankings of eight committees (based on qualitative data) were consistent with stakeholder ranking of accomplishment for all but one of the case studies. The groupings were used to examine specific hypotheses raised in the case study

¹The research did not evaluate biophysical or socioeconomic outcomes because the purpose was to assess approaches to operationalization; furthermore, in none of the cases was there sufficient data or history of monitoring to make such an assessment.

²The groups were identified by listing the committees in order of their mean rankings of accomplishment and using the differences between these means to identify natural groupings.

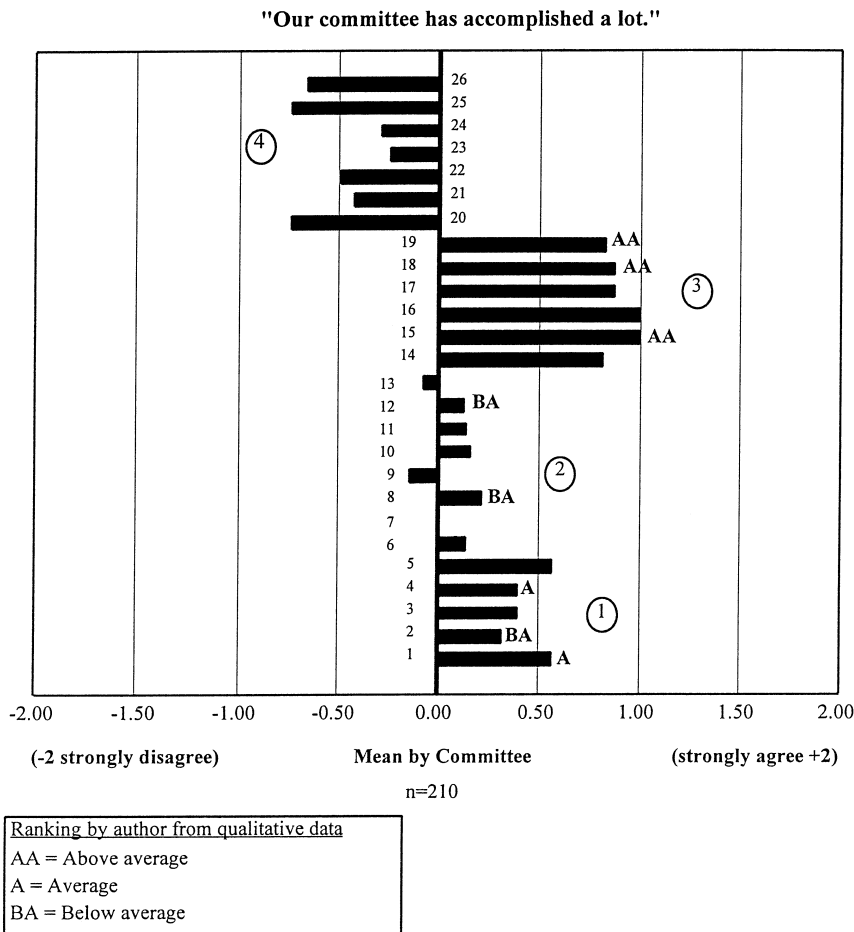


Figure 2. Analysis of committee accomplishment.

Notes: Only cases with five or more responses are included.
 Committee names are not provided due to the confidential nature of the surveys.
 Circled numbers show groupings derived from mean evaluations of accomplishment.
 None of the case studies examined by the author were in group 4.

research by comparing differences between the group means for several variables (see Z scores in Table 2). These data are used strictly as a supplement to case study findings.

The two sets of cases studies and survey produced a set of 20 critical elements. These are the most common factors across all case study and survey findings that appear to be critical for successful operationalization. The author does not suggest that the elements are variables in a predictive sense, because interrelationships and complexity make them difficult to measure independently. Furthermore, local conditions and factors produce unique issues for each case. However, based on the evidence available, the author hypothesizes that the greater number of elements achieved, the greater the likelihood of successful operationalization of integrated environmental management. Thus, these elements are proposed to be the generic attributes or foundations for effective IEM practice.

A Foundation for Successful Practice

The elements are divided into three categories (Table 3). Initiation describes the legal, institutional, and organizational elements that appear to be necessary to initiate an integrated approach (elements 1-5). Operation describes the elements that appear to make IEM stakeholder groups operate effectively (elements 6-10). The third category of elements falls under Outputs and Outcomes, which are the factors that contribute to the successful implementation of a collaboratively developed plan or approach (elements 11-20).

1. Laws and Policies Should Support or Not Prevent an Integrated Approach

Stakeholder-based management efforts began through a number of different processes, including

Table 2. Significance tests of variables^a

Variable	Comparison of committees grouped by accomplishment (groups shown in Figure 1) Mann-Whitney test (Z scores)					
	Group 3 and group 4	Group 2 and group 4	Group 1 and group 4	Group 3 and group 2	Group 3 and group 1	Group 1 and group 2
Accomplishments** Element 5	6.41††	3.12††	4.05††	4.94††	2.07††	2.22††
Coordinator effectiveness**	2.52††	0.32	0.01	2.34††	2.38††	0.32
Elements on process						
Information exchange**	3.25††	1.49	1.14	2.18††	1.57†	0.05
Conflict resolution**	2.68††	0.20	1.23	2.66††	0.81	1.09
Public consultation**	2.77††	1.46	0.17	1.76†	2.20††	0.20
Element 11						
Common goal*	2.65††	1.60†	1.05	1.32	1.23	0.21
Mutual understanding**	3.67††	2.49††	1.10	2.12††	2.10††	0.80
Familiarity**	2.97††	2.88††	1.92††	0.60	0.67	0.28
Element 14						
Agency influence**	4.17††	2.29††	1.23	2.33††	2.00††	0.41
Local government influence	1.50	0.81	0.45	0.83	0.82	0.18
Element 16						
Committee as leader**	4.69††	2.31††	1.64†	3.31††	2.38††	0.01

^aKruskal-Wallis test on variables: ** ≤ 0.05 , * ≤ 0.10 . Significance level for Z scores from Mann-Whitney test: †† $P \leq 0.05$, † $P \leq 0.10$. Note: because groups include more than 20 cases, numbers reported are Z scores. The Kruskal-Wallis test is the nonparametric equivalent to the F test. It tests whether *c* independent sample groups have been drawn from populations possessing equal medians (Berenson and Levine 1989). The Mann-Whitney test is a nonparametric alternative to the *t* test, which can be used to determine whether one population has larger values than the other (Norusis n.d.).

grass-roots efforts. However, the case studies demonstrated that to move beyond a purely advocacy and education role, government laws and policies had to be conducive to integration. In Black Earth Creek (Wisconsin), local stakeholders were the driving force behind planning efforts. However, participants noted that support for an integrated approach from the Wisconsin Department of Natural Resources was important for translating the concept into action. Similarly, an integrated approach to catchment management was not widespread in Queensland and New South Wales until policies and legislation prescribed it.

The cases also revealed that legislation and policies can constrain or prevent integration through a focus on single issues and objectives. For example, prior to the passage of the US Electric Consumers Protection Act, legislation prevented managers on the upper Wisconsin River from addressing environmental and recreation issues during dam relicensing. Similarly, Australia resource managers met resistance when they incorporated environmental restoration provisions into applications for sugarcane irrigation projects. The administering agency required them to delete those components because they did not meet the policy objectives of improving sugarcane productivity. This narrow scope—translated down through the policies, structure, and culture of an organization—is a significant con-

straint to integration. Gilbert (1988, p. 182) notes that lack of support for broad, cooperative programs means that “natural resources are often treated and managed as isolated entities.” The case studies suggest that more subtle constraints are pervasive, which can produce barriers to integration.

2. There Should Be Resources to Support the Collaborative Planning Process

In all of the case studies examined by the author, there was an organization or government body that provided resources to support the collaborative planning process, including staff to coordinate, operational funds for communication and administration, and resources for public meetings, facilitators, publicity and other activities. Both US and Australian participants cited resources and staff as important needs during the planning process. Members of several New South Wales committees emphasized in both interviews and the survey that their lack of a full-time coordinator was a significant inhibitor to progress.

In some cases, citizens were able to initiate efforts, but they were difficult to sustain without resources. For example, a self-funded stakeholder group in southern Queensland successfully launched several watershed

Table 3. Critical elements to IEM success

IEM is more likely to succeed when:	
Initiation	
1.	Laws and policies support or do not prevent an integrated approach.
2.	There are resources to support the collaborative planning process.
3.	Major stakeholders are willing to participate in a collaborative effort.
4.	Stakeholder committee membership and selection processes are deemed legitimate.
5.	There are people with the skills and time to lead the effort.
Operation	
6.	Stakeholders develop clear and effective processes for communicating.
7.	Stakeholders use clear decision rules.
8.	Stakeholders effectively identify and manage conflicts.
9.	Stakeholders consult with the general public.
10.	Stakeholders base management decisions on sound system understanding.
Outputs and outcomes	
11.	Stakeholders foster familiarity, common goals and mutual understanding.
12.	Stakeholders develop a strategic and flexible strategy to guide implementation.
13.	Stakeholders identify management actions that address a full range of factors.
14.	Stakeholders support implementation actions.
15.	Stakeholders identify a model for intervention to achieve management goals.
16.	Stakeholder committees assert their role in management activities.
17.	Stakeholders create structures and mechanisms for coordinating decision making.
18.	Stakeholders support implementation with information and education programs.
19.	There are resources to support or induce implementation.
20.	Stakeholders implement immediate actions to build confidence and momentum.

efforts, but later went bankrupt. Similar findings have been noted in the literature. Carr (1993) found that an Aboriginal group in north Queensland, Australia, was effective as initiators of a community-based catchment management committee. However, her analysis noted that a lack of resources during the early operation greatly limited full participation of all stakeholders. Innes and others (1994) found that stakeholder groups in California often underestimated the staff and resource needs for consensus building.

3. Major Stakeholders Should Be Willing to Participate in a Collaborative Planning Effort

Several case studies demonstrated that unwillingness to participate on the part of major stakeholder groups makes the planning effort considerably more difficult.

Participation includes formal involvement and substantive contributions once involved. In several of the Australian case studies, interviewees noted that some stakeholder committee members were not willing to collaborate. Interviewees believed that these members viewed the planning process with suspicion and became members to protect their interests; this stifled progress and frustrated other members. In most cases, as participants recognized that the role of the stakeholder group was collaborative rather than hierarchical, these participants either resigned or became willing to work with the group. A number of interviewees stated that this initial period was very unproductive and that their committee did not make progress until committee members, or their attitudes, changed.

Similar findings emerged from the US case studies, and the lower Wisconsin River case in particular revealed a dilemma in stakeholder nonparticipation. The 26-member stakeholder committee that was formed to address land use in the lower Wisconsin River valley included a wide range of interests, including a property rights group. Soon after the process began, the property rights group chose to drop out of the process and work against the effort. Ultimately, numerous meetings, surveys, and public involvement sessions negated their opposition, resulting in legislation based on the stakeholder committee's recommendation. However, the decision by the property rights group to not participate made the process more contentious and made it more difficult for the stakeholder committee to respond to their concerns.

An important issue associated with participation is the factors that determine willingness. When participants in the United States and Australia were asked why they were willing to participate, the reasons most often cited were efficiency and input into decision making. State and local government stakeholders in particular perceived benefits of reduced overlap, conflict, and uncertainty, which would improve overall efficiency. Representatives of community and industry groups often cited the importance of participating in a group that could influence management and policies. Similarly, Wood and Gray (1991) found that organizational reasons for participation in collaborative efforts included efficiency, access to resources, and reduction of uncertainty through the development of collective rules. Innes and others (1994) note that participation in consensus building often depends on "stakeholders making an implicit cost-benefit calculation" or an assessment of their best alternative to a negotiated agreement (BATNA) (Moore 1986). However, at the outset of many IEM cases there was no clearly defined issue or conflict about which stakeholders could calcu-

late the costs and benefits of participation. Many stakeholders noted that they make ongoing assessments of committee progress against their own goals and time commitment.

4. Stakeholder Committee Membership and Selection Process Need to Be Deemed Legitimate

In several US cases, stakeholder group recommendations were challenged on the ground that the selection of the stakeholder group biased the outcome. Participants were able to overcome this challenge by demonstrating a clearly defined process, which was open membership to any interested party. The importance of selection and membership was confirmed in the Australian research, because political interference in several committees has significantly undermined their efforts. In New South Wales, elected ministers from both parties have excluded certain groups, weighted committees in favor of certain political affiliations, and even rejected individuals nominated by organizations as their representative. This has created very contentious atmospheres for these committees and many participants specifically cited this as undermining their credibility.

This type of political interference is contrary to the purpose of a collaborative approach, which is to build a broad base of understanding and achieve consensus despite interests and political affiliations (Gray 1989, Wondolleck 1985). Broadly supported consensus will help produce a strategy that is more cognizant of the range of issues and perspectives and that is supported by a wider range of individuals and organizations (Mitchell 1991). If important groups are not represented on the stakeholder committee, the opportunity for consensus in the broader community is lessened. Gray (1989) suggests that there may be an optimum size for stakeholder groups, but both American and Australian groups often used subcommittees and other forums to balance inclusiveness against workability.

5. There Should Be People With the Skills and Time to Lead the Effort

US and Australian stakeholders often cited the coordinator as the single most important person in their effort. When Australian stakeholders were asked open-ended questions about the contributors and inhibitors of success, coordinator effectiveness figured prominently in both categories. A comparison of the committees grouped by their own evaluation of accomplishment indicated a significant difference between at least two of the groups for the variable coordinator effectiveness ($P = 0.03$). Table 2 shows that mean ratings of coordinator effectiveness were higher for groups of committees with higher mean ratings of accomplish-

ment, and the difference is significant in three of the six comparisons ($P \leq 0.05$).

Australian coordinators noted that they needed a wide range of skills, including communication and conflict resolution skills, knowledge of planning processes, an understanding of physical processes, and some understanding of sociology and economics. Not surprisingly, many coordinators indicated that they did not have all the necessary skills when they began their job. A 1994 survey of coordinators in New South Wales revealed a high priority for training in such diverse areas as watershed processes, group facilitation, project management, strategic planning, meeting procedures, and computer skills (Source: New South Wales Department of Land and Water Conservation).

Staff support is also an important issue for coordinators in both the United States and Australia, with many expressing frustration about the time and demands placed upon them. Coordinators in New South Wales believed they were spending too much time on administration and executive support and too little time on committee and community activities (Source: New South Wales Department of Land and Water Conservation). Because of limited support from other organizations and stakeholders, coordinators in both countries tend to have heavy work loads and time demands. In Australia, coordinators are employed full-time in the role, and many noted that burnout and turnover rates are high.

6. Stakeholders Need to Develop Effective and Clear Processes for Communicating

US and Australian stakeholders indicated that effective communication within the stakeholder committee and between the committee and represented organizations was important to effective operation. A number of groups made special efforts to address committee communication procedures. The members of the Lake Winnebago Comprehensive Plan team spent all of their first two meetings discussing operating and communication procedures, which members cited as an important reason for their efficient operation. The Clarence River Catchment Committee held a two-day session with trained facilitators to work on a strategy and simultaneously improve their communication skills. Among the Australian meetings attended by the author, many of the lower performing committees were beset by personal attacks, interruptions, and poor listening skills. Committees that communicated effectively still debated issues, but they listened carefully, allowed everyone to speak, and focused on issues rather than people.

Fisher and Ury (1981) emphasize that groups are most efficient when they address committee communication at the outset through ground rules, before bad

habits emerge. Gray (1989) notes that ground rules can set the tone for meetings and signal how the proceedings will be different from conventional processes. Moote and others (1997) cite a major lesson from their case study of integrated management was the importance of explicit rules of operation, including meeting structure and decision making.

Equally important for effective operation is communication between individuals and the organizations they represent. One quarter of the Australian stakeholders surveyed believed they had insufficient guidance from their organization (16% were not sure; 59% believed they had sufficient guidance). In the Australian case studies, the author observed several meetings where agency or local government representatives were not sure about the extent of their power or unclear about the direction from their organization. Colosi (1983) refers to this as the two-table issue, meaning the relationship between the consensus building effort for IEM and decision making and consensus processes within the represented organization. Several stakeholder groups were effective communicators because they specified the information that representatives should bring to, and take away from, meetings.

7. Stakeholders Need Clear Decision Rules, The Most Effective of Which Is General or Complete Consensus

Ninety-eight percent of Australian stakeholders indicated that their group operated by some form of consensus, which they defined as a situation in which "everyone was willing to live with the decision," or one in which "no one objected to the decision." Similarly, most decisions in the US case studies were based on complete or general agreement. Interviewees in both countries indicated that a consensus approach was often difficult, but it was essential to building support and unanimity over the long run. In a US case where voting was used to decide some major issues, the losing parties often reintroduced discussions and asked for further information or data. Group members stated that they operated more effectively when the committee shifted to a consensual process. Stakeholders in one Australian case also emphasized the importance of making this decision-making process clear to all participants to avoid misunderstanding and confusion.

The literature also emphasizes the importance of consensual decision making in collaboration (Gray 1989, Innes and others 1994, Pasquero 1991). MacKenzie (1993) found that consensus is important not only for reaching an acceptable decision, but also for building long-term trust and support for outcomes. Furthermore, consensus reduces the importance of stakeholder group composition and membership, which is critical in

a voting process. Some groups and individuals may refuse to become involved, fearing that their participation will lend legitimacy to an unacceptable outcome.

8. Stakeholders Should Effectively Identify and Manage Conflicts

The US and Australian case study research showed that conflict is common, difficult to resolve, but important to address for stakeholder success. The author uses the term conflict management because the case studies revealed that stakeholders could not always resolve conflicts. In the US case studies, over one quarter of conflicts had to be bypassed or resolved by third parties. The rest of the conflicts were resolved through additional research, extensive discussion, and/or careful deliberation.

Australian committee members' evaluation of conflict management effectiveness correlated with their groupings of accomplishments in two of the six comparisons ($P \leq 0.05$) (Table 2). Overall, almost 20% of Australian stakeholders surveyed believed that their committee did not handle conflicts effectively ($N = 191$). One of the more common problems revealed in the case studies was a failure to identify conflict. Participants often disagreed without acknowledging the conflict or identifying a strategy for resolving it. The literature emphasizes the importance of stakeholders learning about conflict resolution and developing the necessary skills (see, for example, Fisher and Ury 1981, Jandt 1985, Moore 1986). A collaborative approach does not mean avoiding conflicts or controversy, because as Buntz and Radin (1983) point out, conflict can often lead to positive outcomes if handled effectively.

The US research also showed that it is important for stakeholders to recognize conflict types and apply appropriate approaches. When the author analyzed the conflicts in the United States cases using a typology developed by Lord (1979), it was determined that the majority of the conflicts during consensus building related to concerns about personal impacts (interest conflicts) and value differences (value conflicts). In contrast, the implementation phase was dominated by the technical differences (cognitive conflicts) associated with operationalizing management objectives. As Lord (1979) suggests, different types of conflict required different strategies for resolution.

9. Stakeholders Should Consult With the General Public

Participants in the US case studies emphasized the importance of public involvement in their efforts, and almost all groups allocated considerable resources and staff to the task. Australian committee members also emphasized the importance of public input, but many

believed their efforts were not adequate. Forty-one percent of committee members surveyed did not believe that their committee's consultation efforts were sufficient; only 27% said it was sufficient; 32% were not sure ($N = 192$). Among the Australian case studies, only a handful of committees or their participating organizations allocated significant resources or staff to public input efforts. Public consultation may also be linked to accomplishments, as the committee groupings in Table 2 show that rankings of public consultation were higher for committees with higher rankings of accomplishment and significantly different in three of the six comparisons.

The literature emphasizes the importance of public consultation during both the planning and implementation phases of IEM (Burton 1991, Margerum and Born 1995, Salwasser 1991). Mitchell (1991, p. 272) identifies a range of interests that should be included, but emphasizes that in addition to these stakeholders, there is also the general public, which may express itself through organizations, or belong to the "silent majority."

Interviews with Australian stakeholders showed that some of them confused their role with the role of public input. They assumed that they were representative of the community and therefore their input constituted public involvement. The interviews also revealed that stakeholder attitudes, beliefs, and understanding changed during the course of their interaction, but the attitudes of the people they were representing (either formally or informally) did not necessarily change with them. Their mutual learning and consensus were not always being mirrored in the community. This concern was expressed by several Australian and US farmers who were uncomfortable representing the "farming perspective." They were not sure how their views compared to other farmers because they did not represent a farming organization and because there was inadequate public consultation to provide them with feedback.

10. Stakeholders Should Base Management Decisions on a Sound Understanding of Environmental Systems and Interrelationships

The Australian case study research revealed a critical element not previously identified: the importance of research efforts that coincided with planning and management. Participants pointed out that they were often addressing systems for which there was only single-parameter data or inadequately compiled information. They indicated that an integrated response requires sound systemwide research and data. For example, stakeholders in the Liverpool plains of northwest New South Wales determined through research efforts that

soil salinity was caused in part by rising groundwater levels brought about by past deforestation. As a result, several management actions have focused on developing an agroforestry industry to encourage reforestation.

A reexamination of the US case studies revealed several examples where new research was important. For example, participants involved in hydropower relicensing on the upper Wisconsin River in the United States conducted secondary research on fish mortality rates from hydropower turbines that helped solve technical issues and led to new state review procedures. Participants indicated that their research efforts were important for establishing sound, commonly accepted data and analysis upon which they could base management decisions. Similarly, Syme and others (1994) concluded from their investigation of catchment management efforts that when stakeholders confront unique or specialized issues, they should develop targeted investigations in partnership with researchers.

11. Stakeholders Need to Foster Familiarity, Common Goals, and Mutual Understanding

In a number of US case studies, interviewees often spoke of the importance of familiarity, common goals, and mutual understanding among stakeholders. Australian stakeholders also cited these qualities, and stakeholder rankings of common goals, mutual understanding, and familiarity were higher for groups of committees with higher rankings of accomplishment. These differences were significant in several of the comparisons; for the variable mutual understanding, the difference was significant in four of the six comparisons (Table 2). The differences were also apparent in the Australian committee meetings attended by the author. The more effective committees tended to be then ones with the best rapport among committee members, including a noticeable sense of respect—even during disagreements. Participants in both countries noted the importance of these qualities not only for the group process, but also for facilitating communication and cooperation outside the committee process.

Several researchers describe the cohesiveness and maturity necessary for stakeholders to accomplish their objectives (Innes and others 1994, Pasquero 1991, Syme and others 1994). The literature suggests that groups develop mutual understanding when they develop familiarity, learn to accept different perspectives (even though they may still disagree), and identify commonly accepted data and assumptions (Innes and others 1994). In developing common goals for managing the system, stakeholders identify unifying objectives that provide a common mission (Bührs 1991, Walter 1987).

12. Stakeholders Should Develop a Strategic and Adaptable Strategy to Guide Implementation

Implementation strategies took a variety of forms, including informal agreements, summary documents, and detailed plans. Many participants emphasized the importance of a written plan, but there were varying opinions about the efficacy of their own plan. The most common complaint among US stakeholders was that the planning process took too long and the plan was too detailed, causing participants to focus on the plan as the product. There appeared to be conflicting messages from Australian stakeholders. Although 67% of Australian catchment committee members believe that their plan was useful for guiding the committee, a lack of strategic direction was the third most commonly cited inhibitor of progress. This may be explained by the lack of prioritization evident in many of the plans reviewed by the author. The large number of perspectives and the complexity of the issues make priority setting difficult, and many plans were amalgamations of potential actions rather than a strategy for action. Specifying what will be done, and who will do it by when, forces participants to be realistic and avoid developing what one US interviewee called wish lists. Another member of the same committee noted that they did not make progress until they separated “what would be nice to do” from “what could be done.”

Several researchers emphasize that integrated plans should document the planning process and provide a strategic direction for action (Born and Sonzogni 1995, Johnson and Agee 1988, Lang 1986b, Margerum and Born 1995). Mitchell (1991) also emphasizes that imperfect information and changes in natural and human systems mean that managers often confront uncertainty. Therefore, integration requires an adaptive approach that allows for monitoring, feedback, and adjustment. Similarly, a US participant noted that the plan should be viewed as the beginning of the implementation process rather than the end of the planning process.

Both US and Australian case study participants emphasized that this kind of adaptive approach requires ongoing monitoring. This includes ongoing biophysical monitoring, such as ongoing fishery assessments carried out for the Lake Winnebago Management Plan. Monitoring also includes measuring actions and accomplishments against goals, timelines, or a strategy. For example, the Condamine Catchment Committee in Australia takes time during each meeting to review progress and deadlines, which has helped the group stay focused on primary goals, encouraged group members to fulfill their responsibilities, and acknowledged the contributions of individual members. Furthermore, this helps document the range of accomplishments,

which a review of ICM activities in Australia warned was lacking (AACM and Centre for Water Policy Research 1995). A chair of one catchment committee commented: “Politicians like things they can screw brass plaques into. So many of our accomplishments are institutional and behavioral, and are not tangible—so we need to be really careful to document all of these accomplishments.”

13. Stakeholders Should Develop a Management Approach that Addresses the Full Range of Environmental, Social, and Economic Factors

Many US and Australian stakeholders cited the development of a more holistic and interconnective approach as an important outcome of an integrated approach. Interviewees noted that they developed a more holistic understanding of the environmental, socioeconomic, and institutional systems. Participants cited data and analysis sharing as an important part of this broader analysis. In fact, over 90% of Australian catchment committee members indicated that their committee developed some type of shared database or information system ($N = 92$).

A less commonly cited outcome was a greater awareness of organizational policies and directions, which can help produce management actions more sympathetic to other stakeholders. One Australian participant stated that interaction “is particularly valuable for updates on the organizational dynamics . . . internal politics and agendas . . . , that level of interaction becomes particularly valuable because it means that individual agencies have the capacity to sort of implement and contribute to those agendas.”

The literature also emphasizes the importance of fostering a holistic approach. Dorcey (1995) calls the simultaneous consideration of economic, social, and sustainability goals the “three legs of the stool,” and notes, “we have learnt that to ignore any one of the three legs of sustainability in catchment management sooner or later leads to problems.” Addressing these interrelationships creates tension with the need to be strategic (element 12). Therefore, stakeholders must work iteratively and combine a comprehensive approach that is cognizant of interrelationships with constant review to identify critical strategic actions (Mitchell 1990).

14. Stakeholders Need to Support Implementation Actions

Among the US and Australian case studies, actions were most likely to be implemented when they were specifically assigned to a stakeholder who supported its implementation. In most case studies, the sponsoring state agencies or local government carried out the

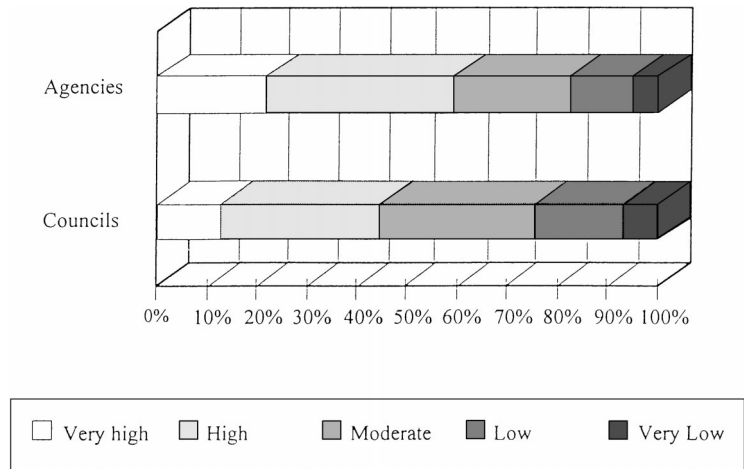


Figure 3. Evaluation of commitment by Australian IEM participants.

n (agency) = 751
n (council) = 405

majority of implementation activities, while the support from other organizations varied widely.

Several questions in the Australian survey focused on support and commitment. Stakeholders were asked whether their committee influenced the actions of state agencies and local government. Table 2 shows that mean ratings of agency influence were higher for groups of committees with higher mean ratings of accomplishment, and the difference was significant in four of the six comparisons ($P \leq 0.05$). There was no significant difference between the groups for the variable local government influence. When participants were asked to evaluate government commitment, about 60% rated state agency support positively, and 40% rated local government support positively (Figure 3). Examining the data by committee, most state agency means were positive (corresponds to very high or high), but mean evaluations of local government were negative for over one third of the catchment committees (corresponds to low or very low). Similarly, when respondents were asked to list the factors that have inhibited and advanced their efforts, agency support, local government support, and stakeholder commitment were among the top ten most common responses in both categories.

One reason for inadequate support among some committees may be the views of IEM stakeholders and their organizations. Interviews with agency representatives in both the United States and Australia revealed that many of them described their participation in terms of “providing information” or “offering their perspective.” This one-way flow of information contrasts with respondents who recognized that their role was also to bring the committee’s perspective back to their organization. When Australian agency partici-

pants were asked in the mail survey to describe their role on the committee, 69% of the responses could be classified as a one-way role, while only 31% could be classified as interactive ($N = 48$).³ For example, responses classified as interactive were: “Provide knowledge about [agency’s] operation in the catchment, receiving feedback and altering—when appropriate—[agency] direction to fit committee’s direction”; and “To represent department policy. To listen to the community.” Responses classified as a one-way role included: “To encourage members to believe that the government is serious about integrated catchment management”; and “To provide technical advice.” These responses indicate that a number of Australian participants view their role on stakeholder groups as advisory rather than as a liaison between the group and their organizations, which would clearly reduce implementation effectiveness.

15. Stakeholders Need Clearly Identified Intervention Leverage Points to Achieve Management Goals

The Australian research suggested that the more successful committees had a clearer concept of how to achieve management goals and where to intervene. Many lagging committees had identified management goals and objectives, but often failed to identify what Julian (1994) refers to as “a model for intervention.” A reexamination of the US research revealed that this was an important part of plan implementation in those cases as well.

For example, the Mary River committee in southeast-

³The sample sizes for these responses were not large enough to examine this variable by committee.

ern Queensland identified streambank erosion as a prime concern. In response, they helped to establish a streambank restoration program that shares the cost with landowners using state and federal funding. This has led to numerous small-scale efforts and to a large-scale restoration project being conducted with a gravel extraction company. Similarly, stakeholders involved in discussions about the lower Wisconsin River, recognized that maintaining the scenic qualities of the river valley required new local government land-use tools. In response, they proposed scenic performance standards enforced by a regional body with local and state government representatives (which was subsequently adopted).

Identifying these leverage points may require a more bottom-up approach to identifying implementation actions, because in most cases participants did not begin with a policy initiative. Elmore (1982) suggests that implementation should start at the lowest level of the implementation process. Having established a relatively precise target at the lowest level, he recommends an analysis approach that works its way back up through the implementing parties to identify the ability and necessary resources to address the problem. "Rather than reason from top to bottom, through successive layers, trying to discover how each layer can control the next, one begins at the point of the problem and tries to find the most parsimonious way of reaching it" (Elmore 1982, p. 29). This type of bottom-up process is also conducive to the mutual trust that stakeholder groups produce.

16. Stakeholder Committees Need to Assert Their Role in Management Activities

Another critical element identified in the Australian research not previously noted in the US case studies was the importance of stakeholder groups asserting their role. In several Australian case studies, participants cited specific events, activities, or series of assertive actions that helped launch their group's influence. This appeared to be more important in the Australian setting, because many committees were created without a predetermined role or primary objective. In the survey of Australian stakeholders, rankings of committee leadership were higher for committees with higher rankings of accomplishment and significantly different ($P \leq 0.10$) in five of the six comparisons (Table 2).

One of the least controversial assertive roles for a stakeholder group is conflict mediator or convenor. For example, members of the Mary River catchment committee in Queensland believed the committee raised its profile when it mediated a long-running local conflict over sand and gravel extraction in the river. The committee chair and coordinator, both of whom are

trained facilitators, helped moderate meetings that led to a negotiated agreement.

A more difficult assertive role for a stakeholder group is to advocate a new approach to planning and management. This can take several forms, including monitoring government decision making, developing new policies, and promoting more integrated decision making. For example, the Lockyer Resource Management Group in Queensland developed a controversial position paper on land-use management in the Lockyer valley. Because of the controversy, the group has become recognized as a significant player in the region, and many believe that land-use planning has improved because of it (Stone and Long 1995).

17. Stakeholders Need to Create Structures and Mechanisms for Coordinating Decision Making

When the author examined implementation progress in the US case studies, one important output was structures and mechanisms for facilitating ongoing coordinated decision making. Similarly, many Australian stakeholders noted that without ongoing committee and working party participation, their strategies would not have progressed. The committees that appeared to be most effective were those in which participants developed clearly articulated, regularized processes of information exchange and joint decision making. Mitchell (1991) also found that a "linked system" of management in the Fraser River estuary allowed the variety of interests to work together towards common goals while retaining their individual powers.

This lesson was particularly clear in the US Milwaukee River watersheds case. Due to different legislative bases, participants prepared an integrated management plan and a nonpoint source control plan for each subwatershed. While the nonpoint plans have moved forward, many actions in the integrated plans have not. Participants specifically cited the ongoing management committees created for the nonpoint plans as one of the chief reasons for their better progress.

The US and Australian case studies also revealed that the institutional structure for coordinating often becomes more complex during implementation. While the planning phase tends to involve one stakeholder committee, the implementation phase tends to involve a primary committee and several subcommittees or working groups. This appears to be particularly important for coordinating daily management activities. For example, state agencies, a port authority, and a local council in the Trinity inlet in northern Queensland have agreed to share information about development proposals near the Inlet. A steering committee sets the strategic direction with input from several advisory

committees, while a technical committee coordinates operational management activities.

18. Stakeholders Need to Support Implementation with Information and Education Programs

When Australian participants were asked about their accomplishments, one of the most often cited was information and education activities. In reassessing the US case study data, the author found that a number of participants also cited these as important outputs. Australian stakeholders noted that the activities provided a mutually acceptable goal, publicity for the committee, and an immediate action. Furthermore, education efforts were often important compliments to voluntary and incentive-based implementation programs.

Interviewees cited two types of efforts that they believed were especially successful. First, participants believed that education efforts involving children helped inform future generations and often led to adults being informed through their children. Second, participants believed that targeted efforts designed to involve and educate people have been especially successful. In many parts of rural Australia, the regional approach of catchment committees has worked well when combined with local "Landcare" groups. Typically, these are local groups of landowners concerned about local soil or water problems who come together, learn about these problems, and take action to remediate them. These efforts are supported with facilitators, technical advice, and funding for demonstration projects. Campbell (1994) suggests that the approach has helped promote community-wide commitment to better land management.

19. Resources Are Needed to Support or Induce Implementation

Both the US and Australian case studies showed that resources are important to implementation. Most stakeholder implementation actions were allocated resources, whether in the form of grants, in-kind support, funding or staff from government entities, or through the time allocated by stakeholder coordinators. The case studies also revealed higher costs for implementation. The planning phase was typically conducted with a coordinator, and sometimes administrative support, while implementation actions required considerably more staff and funding. Importantly, many stakeholders noted that implementation funding and grants often produced a multiplier through in-kind support, private sector funding, and volunteer activities.

The importance of funding was particularly evident in the Australian case studies, which typically depended

upon a wider variety of smaller funding sources than their American counterparts. In the Australian survey, respondents most often cited lack of funding as an inhibitor to progress. When asked whether their committee's resources were adequate, 54% believed they were not, 23% believed that they were, and 23% were not sure ($N = 157$). New federal funding introduced in 1996 (National Heritage Trust) has considerably boosted the implementation activities of many catchment committees. Some catchment committees have also looked to other sources of funding. For example, in New South Wales catchment trusts have the authority to levy taxes, and several Australian committees receive personnel and office funding from local governments.

20. Stakeholders Need to Implement Immediate Actions or Activities to Build Confidence and Momentum for Future Activities

The immediate actions and activities of several Australian committees helped build trust, pride, and an esprit de corps among committee members that produced momentum to move forward on other objectives. This did not emerge as clearly in the US research, but a reexamination of interview data revealed that US stakeholders often cited early projects and activities as important to long-term success. Furthermore, MacKenzie (1993) found that short-term success is often important for sustaining political support.

For example, after the start of the planning process for the Milwaukee River watersheds project, participants collaborated to remove the Wollen Mills Dam in the city of West Bend. State and local government worked collaboratively to remove the dam, convert the new land to a park, create trails and a boat launch, and improve fish habitat. Participants cited the importance of the project for demonstrating how participants could work together, generating tangible outcomes, and demonstrating the benefits of impoundment removal to people throughout the region. In other cases, initial successes with projects generated momentum that grew into larger activities. For example, the Georges River catchment committee in metropolitan Sydney held a cleanup day for a degraded tributary called Saltpan Creek. The successful event led to a second cleanup of large items using local council equipment, and subsequently the three local councils along the creek developed a stormwater management plan.

Concluding Remarks

The elements presented above were derived from the experiences of a wide range of case studies and stakeholders. Many of these stakeholders praised the

virtues of IEM, even when their experience fell below their expectations. As suggested in the literature, they argued that IEM better reflects the complexities and interconnections of environmental systems. They cited IEM as an improvement over many current management approaches, but clearly recognized that it is not a panacea. It has important limitations, some of which need to be briefly highlighted here. First, as Mitchell (1986, p. 23) points out, "situations may well exist where an integrated approach is not required." Integration clearly involves transaction costs, and some isolated problems may be addressed more effectively through limited and focused approaches.

Second, IEM must take place within many of the existing constraints and limitations of society, which Pasquero (1991) notes is often unrecognized by many collaborative problem-solving models. Similarly, Roberts and Bradley (1991) found that collaborative approaches tend to produce incremental changes rather than radical ones.

Third, some settings will not be conducive to an IEM approach. Gray (1989) and Mitchell (1986) point out that the success of collaborative approaches is likely to be limited when confronted by such factors as basic ideological differences, constitutional issues, power of unilateral action, and entrenched antagonism, and some issues and conflicts cannot be resolved on a regional scale or in the context of a stakeholder group.

Finally, IEM is proposed as an improved philosophy and process, but it makes no assumption that a stakeholder group's goals or objectives are "correct." As noted by Born and Sonzogni (1995), IEM is not an end in itself, but a means to achieving any number of ends identified by a set of stakeholders working within a complex environmental management institution. Stakeholders define the goals and objectives for each effort, and therefore the approach must undergo the same critical examination applied to any other management approach.

In conclusion, IEM has evolved from a desire to address the complexities of environmental system and the associated political and socioeconomic issues. It is based on the philosophy that a diverse group of stakeholders, supported by public input, can translate the concept into operation by collaboratively developing new strategies for management and implementing them. The author proposes that the elements listed above are the building blocks for the successful development and implementation of integrated environmental management. Adhering to the elements does not assure success, but the research suggests that it will greatly improve the likelihood of effective practice. The challenge for both researchers and practitioners is to test and refine these

elements to assist future efforts and produce a more explicit model for integrated environmental management.

Acknowledgments

This research was made possible by funding from the Australian-American Fulbright Commission. The author acknowledges the support of the Centre for Water Policy Research at the University of New England, Armidale, Australia. The author would also like to thank R. S. DeSanto, R. L. Heathcote, and two anonymous reviewers for their comments and suggestions.

Literature Cited

- AACM and Centre for Water Policy Research. 1995. Enhancing effectiveness of catchment management planning. Final report to the Australian Department of Primary Industries and Energy.
- Berenson, M. L., and D. M. Levine. 1989. Basic business statistics: Concepts and applications, 4th ed. Prentice-Hall, Englewood Cliffs, New Jersey.
- Born, S. M., and W. Sonzogni. 1995. Towards integrated environmental management: strengthening the conceptualization. *Environmental Management* 19(2):167-183.
- Bührs, T. 1991. Strategies for environmental policy coordination: The New Zealand experience. *Political Science* 43(2):1-29.
- Buntz, G. C., and B. A. Radin. 1983. Managing intergovernmental conflict: The case of human services. *Public Administration Review* 43(5):403-410.
- Burton, J. 1992. Catchment management in Australia—an historical review. In *Catchments of green: A national conference on vegetation and water management*. Adelaide, Australia, 23-26 March 1992. Greening Australia, Canberra, Australia.
- Burton, J. R. 1991. Integrated catchment management and its links with public works facilities. Brisbane, Australia: Asia-Pacific Public Works Congress. 5 September 1991.
- Campbell, A. 1994. *Community first: Landcare in Australia*. International Institute for Environment and Development, London.
- Carr, A. 1993. Catchment co-management: The case of the Mitchell River watershed management working group. Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia.
- Clark, T. W., E. D. Amato, D. G. Whittemore, and A. H. Harvey. 1991. Policy and programs for ecosystem management in the greater yellowstone ecosystem: An analysis. *Conservation Biology* 5(3):412-422.
- Colosi, T. 1983. Negotiation in the public and private sectors: A core model. *American Behavioral Scientist* 27(2):229-253.
- Daniels, S. E., and G. B. Walker. 1996. Collaborative learning: Improving public deliberation in ecosystem-based management. *Environmental Impact Assessment Review* 16(2):71-102.

- Dodge, D. P., and R. M. Biette. 1992. River protection in Ontario, Canada: A case for holistic catchment management. Pages 443–451 in P. J. Boon, P. Calow, and G. E. Petts (eds.), *River conservation and management*. John Wiley & Sons, New York.
- Dorcey, A. H. J. 1995. Catchment governance for sustainability: Collaborating to put principles into practice. Newcastle, Australia: 1995 Australia–New Zealand Association for the Advancement of Science Congress. 24–27 September 1995.
- Elmore, R. F. 1982. Backward mapping: Implementation research and policy decisions. Pages 18–35 in W. Williams (ed.), *Studying implementation: Methodological and administrative issues*. Chatham House Publishers, Chatham, New Jersey.
- Fisher, R., and W. Ury. 1981. *Getting to yes: Negotiating agreement without giving in*. Penguin Books, New York.
- Gilbert, V. C. 1988. Cooperation in ecosystem management. Pages 180–192 in J. K. Agee and D. R. Johnson (eds.), *Ecosystem management for parks and wilderness*. University of Washington Press, Seattle.
- Gray, B. 1989. *Collaborating: Finding common ground for multiparty problems*. Jossey-Bass, San Francisco.
- Grumbine, R. E. 1994. What is ecosystem management? *Conservation Biology* 8(1):27–38.
- Innes, J., J. Gruber, M. Neuman, and R. Thompson. 1994. *Coordinating growth and environmental management through consensus building*. California Policy Seminar, Berkeley, California.
- Jandt, F. 1985. *Win win negotiating: Turning conflict into agreement*. John Wiley & Sons, New York.
- Johnson, D. R., and J. K. Agee. 1988. Introduction to ecosystem management. In J. K. Agee and D. R. Johnson (eds.), *Ecosystem management for parks and wilderness*. University of Washington Press, Seattle.
- Julian, D. A. 1994. Planning for collaborative neighborhood problem-solving: A review of the literature. *Journal of Planning Literature* 9(1):3–13.
- Lang, R. 1986a. Introduction. Pages 1–12 in R. Lang (ed.), *Integrated approaches to resource planning and management*. The Banff Centre, Calgary, Alberta, Canada.
- Lang, R. 1986b. Achieving integration in resource planning. Pages 27–50 in R. Lang (ed.), *Integrated approaches to resource planning and management*. The Banff Centre, Calgary, Alberta, Canada.
- Lord, W. B. 1979. Conflict in federal water resource planning. *Water Resources Bulletin* 15(5):1226–1235.
- MacKenzie, S. H. 1993. Ecosystem management in the Great Lakes: Some observations from three RAP sites. *Journal of Great Lakes Research* 19(1):136–144.
- Margerum, R. D., and S. M. Born. 1995. Integrated environmental management: Moving from theory to practice. *Journal of Environmental Planning and Management* 38(3):371–391.
- Mitchell, B. 1986. The evolution of integrated resource management. Pages 13–26 in R. Lang (ed.), *Integrated approaches to resource planning and management*. The Banff Centre, Calgary, Alberta, Canada.
- Mitchell, B. 1990. Integrated water management. Pages 1–21 in B. Mitchell (ed.), *Integrated water management: International experiences and perspectives*. Belhaven Press, London.
- Mitchell, B. 1991. “BEATing” conflict and uncertainty in resource management and development. Pages 268–285 in B. Mitchell (ed.), *Resource management and development*. Oxford University Press, Toronto, Canada.
- Mitchell, B., and M. Hollick. 1993. Integrated catchment management in Western Australia: Transition from concept to implementation. *Environmental Management* 17(6):735–743.
- Moore, C. W. 1986. *The mediation process: Practical strategies for resolving conflict*. Jossey-Bass, New York.
- Moote, M. A., S. Burke, H. J. Cortner, and M. G. Wallace. 1994. *Principles of ecosystem management*. Water Resources Research Center, University of Arizona, Tucson, Arizona.
- Moote, M. A., M. P. McClaran, and D. K. Chickering. 1997. Theory in practice: Applying participatory democracy theory to public land planning. *Environmental Management* 21(6):877–889.
- Norusis, M. J. n.d. *SPSS 6.1 guide to data analysis*. Prentice Hall, Englewood Cliffs, New Jersey.
- Pasquero, J. 1991. Supraorganizational collaboration: The Canadian environmental experiment. *Journal of Applied Behavioral Science* 27(1):38–64.
- River Federation. 1994. *Institutional frameworks for watershed management programs: Profiles and analysis of selected programs*. Prepared for the US Environmental Protection Agency. Silver Spring, Maryland.
- Roberts, N. C., and R. T. Bradley. 1991. Stakeholder collaboration and innovation: A study of public policy initiation at the state level. *Journal of Applied Behavioral Science* 27(2):209–227.
- Salwasser, H. 1991. In search of an ecosystem approach to endangered species conservation. In K. A. Kohm (ed.), *Balancing on the brink of extinction: The endangered species act and lessons for the future*. Island Press, Washington, DC.
- Shrubsole, D. A. 1990. Integrated water management strategies in Canada. In B. Mitchell (ed.), *Integrated water management: International experiences and perspectives*. Belhaven Press, London.
- Slocombe, D. S. 1993. Environmental planning, ecosystem science, and ecosystem approaches for integrating environment and development. *Environmental Management* 17(3):289–303.
- Stone, G., and P. Long. 1995. *Appraisal of the Lockyer Valley ICM pilot study*. Gordon Stone and Associates. Toowoomba, Queensland, Australia.
- Syme, G. J., J. E. Butterworth, and B. E. Nancarrow. 1994. *National whole catchment management: A review and analysis of process*. The Land and Water Resources Research and Development Corporation, Canberra, Australia.
- Thomas, R. L., J. R. Vallentyne, K. Ogilvie, and J. D. Kingham. 1988. The ecosystems approach: A strategy for the management of renewable resources in the great lakes basin. In K. L. Caldwell (ed.), *Perspectives on ecosystem management for the great lakes*. State University of New York Press, Albany.

- US EPA. 1993. Geographic targeting: Selected state examples. US Environmental Protection Agency, Office of Water, Washington, DC.
- Walther, P. 1987. Against idealistic beliefs in the problem-solving capacities of integrated resource management. *Environmental Management* 11(4):439-446.
- Wondolleck, J. 1985. The importance of process in resolving environmental disputes. *Environmental Impact Assessment Review* 5:341-356.
- Wood, D. J., and B. Gray. 1991. Towards a comprehensive theory of collaboration. *Journal of Applied Behavioral Science* 27(2):139-162.
- Yin, R. K. 1989. Case study research: Design and methods. Sage Publications, Newbury Park, California.