The Challenges of Integration: Report of an On-line Consultation among Researchers of the Alternatives to Slash-and-Burn (ASB) Programme

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Draft: 2.0

Revised: 8 April 2004

Portions of this report (emphasizing sections III and IV) were presented as a paper entitled "The Challenges of Integration: Insights from integrated natural resource management research in the tropical forest margins by the Alternatives to Slash-and-Burn Programme" at the Millennium Ecosystem Assessment Workshop,"Bridging Scales and Epistemologies", Alexandria, Egypt, 17-19 March 2004

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Abstract

The Alternatives to Slash-and-Burn (ASB) programme is a decade-old, complex, multi-institutional, multi-disciplinary, multi-site research and development consortium. ASB applies an integrated natural resource management (iNRM) approach to analysis and action regarding tradeoffs between global environmental concerns and local rural development opportunities in the forest margins of the humid tropics. Addressing these issues necessarily involves analysis at many scales and interaction across epistemologies (knowledge systems). ASB has been recognized for its success in producing scientific outputs and real world impacts and as a pioneer in iNRM. But, until now, the consortium has devoted little effort to understanding its success in bridging scales and epistemologies. To fill this gap, an on-line consultation was held involving 42 ASB researchers and structured following an analytical framework on "harnessing science and technology for sustainability" developed by Harvard University researchers based on their studies of other comparable cases. This analytical framework includes 4 dimensions of integration (disciplinary, functional, spatial/temporal, and knowledge) and related challenges of institutional learning and adaptation, fostering appropriate participation, and managing resource and capacity constraints. A special website was developed for ASB's virtual consultation, which was professionally facilitated. This innovative use of information technology proved to be an effective means of triangulating perceptions of spatially dispersed researchers. Electronic polling was used to identify areas of consensus or broad agreement, as well as areas where views diverged. The cases of divergence received special attention in open ended 'virtual' discussions. Results reported in this paper advance understanding of the scope and limits of a complex international consortium to integrate information across disciplines, institutions, scales and knowledge systems. Conclusions emphasize hypotheses that may be of interest to other research or assessment teams endeavoring to bridge scales and epistemologies.

Keywords: humid tropical forest margins; integrated natural resource management; organizational learning; participatory approaches

Contents

I. Introduction

II. Background on the ASB Consortium

2.1. ASB's iNRM paradigm

2.2. Multiple scales

2.3. Multiple epistemologies

III. Methods for Process Documentation

3.1. Analytical framework

3.2. On-line consultation

3.3. Process

3.4. Participation and potential biases

IV. Challenges of integration

4.1. Disciplinary integration

4.2. Functional integration

4.3. Spatial and temporal integration

4.4. Knowledge integration

4.5. North-South integration

4.6. Clear problem definition, but are priorities clear?

V. Other challenges affecting integration

5.1. Institutional learning and adaptation

5.1.1. ASB learns and adapts

5.1.2. How does learning occur within ASB?

5.1.3. Flexibility versus stability

5.2. Participation of groups with conflicting interests

5.2.1. Learning, adaptation and participation

5.2.2. Broadening participation within ASB

5.3. Resource and capacity constraints

VI. Conclusions regarding integration to bridge scales and epistemologies

VII. Acknowledgments

VIII. References

Annexes: Poll questions and results

I. Introduction

The Alternatives to Slash and Burn (ASB) programme increasingly is recognized as a successful pioneer in research and development on integrated natural resource management (iNRM) in the humid tropics. For example, the first review of its system-wide programmes with an ecosystem approach by the Consultative Group on International Agricultural Research (CGIAR) concluded that "The Alternatives to Slash and Burn Programme has gone further than the others in relating its research sites to the whole area over which the problem occurs, and in scaling up to the global level in its findings on tradeoffs … This is very helpful for the global debate on sustainability issues" (CGIAR 2000, p. xix). And, according to a May 2003 World Bank report, "ASB has been applauded … for innovative field research, strong science, and for going furthest within the CGIAR toward implementing effectively a holistic, ecoregional approach founded on in-depth local research linked methodologically across long-term benchmark sites around the world to permit effective scaling up to global level. The intellectual value of this work has derived from the synthesis afforded by careful methodological coordination across sites on different continents, and close working relationships with ARIs [advanced research institutes] and NARS [national agricultural research systems]" (Barrett, 2003, p. 15).

In their review of "institutional challenges for harnessing science and technology for sustainability," Clark et al. (2002, page 6) conclude that the challenge of "integration" in various dimensions "has arguably become the clarion call among advocates of sustainability science". ASB partners have produced more than 500 scientific publications and important real world impacts since consortium activities were launched in 1994. To date, ASB has concentrated on producing these scientific outputs (e.g., the ASB matrices), but has devoted much less attention to understanding and documenting the processes and institutional innovations that have made this possible. Of ASB's 500 scientific publications, only about five focus on organizational process issues (Bandy and Swift, 1995; Gottret and White, 2001; Liu, 2003; Sanchez et al. 2004; and the present paper).

One of the keys to ASB's success likely has been this focus on scientific output and on results. But ASB scientists have not taken much time at all to think about "how we do it". Now that ASB is being viewed by some as a research and development prototype for integrated natural resources management (iNRM), people may want to know how ASB does things. But what helps the ASB consortium to be successful? And what are ASB's weaknesses? In addition to direct value to participants in the ASB consortium, insights on ASB's processes also may be relevant for the Millennium Ecosystem Assessment (MA) and other integrated assessments seeking to address this "challenge of integration".

II. Background on the ASB Consortium

ASB is the only crosscutting assessment approved by the MA (for more information, see Tomich and Palm, 2004). The consortium works at the nexus of two important problems: tropical deforestation and human poverty. Deforestation is often blamed on the slash-and-burn practices of migrant smallholders, millions of whom do clear and cultivate small areas of forest by this method. However, other groups also are involved, including plantation owners, other medium- and large-scale farmers, ranchers, logging groups and state-run enterprises and projects. These groups often clear much larger areas, leading to conflict with traditional users.

ASB was conceived at a workshop in Brazil just after the UN Conference on Environment and Development (UNCED) meeting in Rio de Janiero in 1992. It was launched in 1994 as a system-wide program of the Consultative Group on International Agricultural Research (CGIAR) and is convened by the Nairobi-based World Agroforestry Centre (ICRAF). ASB is a global partnership of over 50 institutions around the world. The goal of ASB is *to identify and articulate combinations of policy, institutional and technological options that can raise productivity and income of rural households without increasing deforestation or undermining essential environmental services*. Although there are some opportunities to reduce poverty while conserving tropical forests, tropical deforestation typically involves tradeoffs among the concerns of poor households, national development objectives and the environment.

Through its network of sites that spans the humid tropics, ASB ensures that its global analyses are grounded in local and national realities. ASB's thematic working groups--on biodiversity, climate change, agronomic sustainability and sustainable land use mosaics, economic and social indicators, and global synthesis of implications for policy, institutional, and technological options--develop innovative methods as needed and ensure that data are comparable across sites. (For more information, please visit the ASB website at http://www.asb.cgiar.org.)

2.1. The iNRM Paradigm

ASB has made seminal contributions to the evolving integrated natural resource management (iNRM) paradigm employed by the CGIAR and its partners. This INRM model is characterized by a process-oriented, systems approach at multiple scales, with participation of multiple stakeholders and an emphasis on measurement and scaling of tradeoffs and impacts across alternatives (Figure 1). Although the iNRM approach remains in its early stages, the following characteristics have been identified by ASB as integral components of the process:

Problem analysis. iNRM in ASB starts with problem analysis. An integrated analysis of a broad range of land use alternatives must quantify the local, national and global benefits they entail as well as the institutional realities that may favor or hinder their further development in three distinct dimensions: (1) enhanced **human well-being**, (2) enhanced **ecosystem integrity** and resilience, and (3) enhance **productivity** of land and labor.

Analysis of trade-offs across ranges of flexible options. ASB researchers summarize the indicators of local, regional and global benefits of a range of land use options in a matrix format, and then analyze the trade-offs and synergies for a range of management intensities within the major systems (Tomich et al. 1998). For the land use practices that are attractive from a local economic perspective as well as a global environmental perspective, we analyze the various factors that influence farmer decision making, including the economic and institutional (dis)incentives provided by current policies.

[Figure 1 goes about here.]

2.2. Multiple scales

ASB works at a range of scales, including the global, continental, national, benchmark (or local), watershed, community, and farm/household levels, with initial focus on the local, farm and household levels and current focus on intermediate scales (watershed) and global relevance (Palm et al. 2000). The **global level** consists of the humid tropical broadleaf forests and deforestation fronts of the three continents. It is at this level that data are ultimately integrated for identification of global trends and differences and for extrapolation purposes. The three **continental areas** comprise the forest margin zones of Southeast Asia (Montane and Insular),

Latin America (the Amazon Basin), and sub-Saharan Africa (the Congo Basin). Within each of the continents we focused on a few countries with high (past/current) rates of deforestation (Brazil, Cameroon, Indonesia, Peru, Philippines, Thailand) and these were classified according to broad agroecological zone. At the local scale within each country, **benchmark areas** were selected where the intensive fieldwork was conducted. Within the benchmark areas a number of **communities/villages** were chosen to represent a range in demographic conditions, land-use histories, and land-use typologies. The **farm or household** refers to the unit of study within the community. Finally, many of the indicators are expressed at the **plot** (land use) level.

Explicit use of nested scales is important for a) sampling methods for quantitative data collection based on initial typologies and strata and helping to refine them for further work, b) recognition of the 'scaling rules' for quantitative properties used in the various criteria and indicators and the impact of differences between scaling rules of the various indicators on the perceived trade-offs, and c) understanding of needs of specific users at various scales (e.g., farmers and local communities; national policymakers) linked to these tradeoffs.

2.3. Multiple epistemologies

ASB is primarily a problem-driven research consortium. Thus scales of analysis and reporting were defined with reference to specific user problems. ASB users' needs are explicitly recognized at the level of the household (farm), local (sub-district or equivalent) government and provincial or national government, through active dialogues. In some cases, the process of identifying the appropriate scale for analysis and reporting has been a research activity in itself extending over a period of several years.

ASB employs a number of highly practical approaches to bridge scales as well as the various knowledge systems involved (local knowledge in rural communities, policymakers' knowledge, and scientific knowledge). These approaches draw on the literature on indigenous knowledge and environmental learning (especially work by F Sinclair and L Joshi), integrated natural resource management (Campbell and Sayer 2003), policy research, and negotiation support (Van Noordwijk et al. 2001). Several of these approaches owe much to earlier work on farming systems research (e.g., Byerlee et al. 1982; Collinson, 2000) and participatory methods (e.g., Chambers et al.1989). More recent literature on boundary organizations (Guston 2001; applied to ASB by Liu 2003) is quite relevant to the potential mechanisms of transmission of information among local communities, scientists, civil society, and policymakers. There are strong divergences among the views of these different groups (documented for the ASB Peru case by Fujisaka (2000)). For a problem domain in which tradeoffs and conflicting interests are rife, conflict management is a major challenge, specifically regarding scope for developing and distributing relevant knowledge across groups with conflicting interests. A major outcome of ASB activities has been a contribution to policy dialogues at the local and national level on the ways ecosystem functions can be maintained in the context of development. For example, official recognition of the valuable role of agroforests and other sustainable land-use systems at a national and local level provides a first step towards empowering the farmers that understand and manage these systems.

III. Methods for Process Documentation

As described above, the ASB consortium involves a diverse range of scales, epistemologies, disciplines, functional roles, and sites spanning the tropics. One prerequisite for documenting and analyzing the ASB consortium's processes is to identify an analytical framework with sufficient scope and flexibility to accommodate this programmatic diversity. Another, even bigger, challenge is to identify a method to document ASB scientists' perspectives on ASB processes and to explore areas of convergence and divergence in their views. Because of the multiple dimensions of diversity in perspective and place within the ASB consortium, no single individual or small group can legitimately or credibly lay claim to 'the truth' about ASB. Indeed, it is likely that no two ASB colleagues will have the same view. Moreover current viewpoints may differ from those involved in the 'early days'.

3.1. Analytical framework.

A developing collaboration with researchers in the "Sustainability Science" group based at Harvard University's Kennedy School of Government has provided an analytical framework for analyzing ASB's approach to "Institutional challenges for harnessing science and technology for sustainability" (Clark et al., 2002; www.sustainabilityscience.org). This framework, which is derived from analysis of scores of case studies, explicitly addresses the challenges of integration (disciplinary, functional, spatial, and temporal). Thus it is particularly well suited as a point of departure for analysis of the ASB experience and would seem to hold potential for relevance to other efforts to "bridge scales and epistemologies." The "Sustainability Science" framework encompasses other elements too -- including institutional learning and adaptation; participation (both for legitimacy and discovery); and strategies for managing resource and capacity constraints, with which ASB has considerable experience. The on-line consultation described below and this paper both follow the structure of the analytical framework developed in Clark et al. (2002). Short selections from Clark et al. (2002) were used as background reading for participants at the beginning of each topic.

3.2. On-line consultation

A consultation "The Truth about ASB" was designed for current participants in ASB and ASB alumni to contribute their insights based on their experience with four key challenges that the ASB consortium has faced over the years: integration, institutional learning and adaptation, participation, and resource and capacity constraints. The virtual consultation focused on each topic in the analytical framework in turn, testing basic premises and exploring divergent perceptions.

Because of the distributed nature of ASB, this collective reflection on ten years of ASB experience was conducted in a facilitated, asynchronous on-line environment . Based on previous ASB team experience on-line, a structured activity in an asynchronous, virtual format had been shown to be an effect means of involving spatially dispersed participants (in this case five continents). (Participants also had the option of participation by email if they lacked good access to the worldwide web; however, this proved cumbersome for the few participants who opted for email participation.)

On-line facilitation services and 'Web Crossing' software enabled the virtual team to provide input on-line to document ASB processes from various perspectives. This has the great advantage of triangulating the perceptions of processes and key turning points in ASB's

development from the perspective of the 42 participants. The current ASB Global Coordinator took the lead in preparing material for polls and discussion. Poll results and participants' interventions were automatically documented on-line. The results of polls and insights that were shared on-line are the 'data' for this multi-author publication.

3.3. Process

Two 2-week consultation sessions were designed to solicit the views, ideas and perceptions of the ASB team about their work and ASB processes. The special website opened for "virtual" participation on 13 November 2003. A "soft opening" from 13-16 November gave participants a chance to get oriented. The first session, from 17-28 November, focused on how ASB grappled with the challenge of integration across disciplines, functions (institutions), spatial and temporal scales, and different types of knowledge. The second session, which ran from 12-23 January 2004, covered three other challenges a) has ASB adapted and learned? If so, how? b) has ASB enabled participation by different stakeholders and users? c) how has ASB coped with funding uncertainties and other resource constraints?

On-line participants could contribute to the "virtual" discussion by posting text on the worldwide web. The special website was designed to be as easy to use as possible, and the facilitators assisted participants in getting acquainted with the software, navigating, and in posting opinions. On-line participants were able to read comments from colleagues and instantly received results of on-line polls. However, they did not see others' responses until they had completed the polls themselves.

For each topic, one or more electronic polls were used to establish a common baseline for open-ended discussions. The polls consisted of sets of short, provocative questions to which participants were given five response options: strongly agree, agree, neither agree nor disagree/don't know, disagree, strongly disagree. Because of cultural differences in views on appropriate means of expressing disagreement, it was emphasized to participants that while consensus is fine it also is alright if people disagree as part of a learning process. Questions and tabulated responses for all polls are included in the Annex.

Members of the ASB global coordination team reviewed the results of the polls to identify areas of **consensus** (where no one disagreed), **broad agreement** (where over 75% agreed or strongly agreed), and of **divergent views** (when 25% or more disagreed or strongly disagreed). Based on these results, a few key topics were selected to help extend and focus the open-ended discussions on each topic. In response to feedback after the first session, polls for the second session were redesigned in an effort to link specific poll questions to associated discussion topics and to focus participants on fewer threads of discussion. Regular emails were sent to participants by the global coordination team to review progress, highlight key points, and stimulate participation.

3.4. Participation and potential biases

All current and past ASB Global Steering Group members (the governing body of the consortium), regional and national facilitators, thematic working group leaders, global coordination office staff, and other active ASB scientists were invited to participate. A total of 109 potential participants in these categories were invited by email to participate.

34 participants joined in the virtual consultation and 8 others chose the email option. The 42 participants are nearly 40% of the potential. No systematic data were collected on reasons for

non-participation, but lack of time or conflicts with travel schedules (impairing access to email or the web) are the most likely reasons for many and were specifically mentioned by several who declined the invitation. The invitation informed potential participants that the event was designed with an expectation that they would devote about one hour a week during each session. Respondents to an evaluation after the first two-week session indicated that the hour per week expectation was reasonable, but many of those respondents also chose to devote significantly more time to the event. Respondents to the mid-term evaluation also indicated that competing work responsibilities were the main limit to their participation in the event.

There was a good balance by gender, country of origin, and length of experience with ASB among the 34 on-line participants:
15 (44%) are female
16 (47%) are from developing countries.
20 (59%) are 'veterans' with more than 5 years experience with ASB
8 (24%) are 'newcomers' with less than 2 years experience with ASB

Participants were free to select topics on which to focus their attention and were not expected to answer all polls or to post comments in every discussion. The tabulation below indicates the number of participants who responded to each poll (poll questions and results are appended as annexes to this report).

Poll	**Questions**	**Respondents**
#1. Integration: disciplinary (part 1)	12	25
#2. Integration: disciplinary (part 2)	11	25
#3. Integration: functional	16	24
#4. Integration: spatial and temporal	18	23
#5. Integration: knowledge	18	24
#6A. Institutional learning and adaptation: Does ASB learn and adapt?	4	19
#6B. Institutional learning and adaptation: How have you learned?	5	19
#6C. Institutional learning and adaptation: Flexibility versus stability	3	17
#7A. Participation: Learning, adaptation and participation	1	18
#7B. Participation: Broadening participation	6	16
#8. Resource and capacity constraints	4	15

Participants were informed at the outset that, in addition to responding to polls, they were expected to contribute a few sentences or paragraphs of their opinions at least twice in each of the two sessions. The number of substantive posts ranged from 0 (some participants only took polls) to a high of 15. These posts range from a few words to several paragraphs. While *quantity* of posts generally is not a good indicator of the *quality* of ideas shared, the

subjective assessment of the facilitators (a professional consultant and the ASB global coordinator) was that the quality of the discussions on-line was high.

The 19 contributing authors of this paper are those who posted four or more substantive comments and/or have contributed text used in this paper. The zero-order draft was sent by email to the total potential population (including those who participated in the event) in another effort to seek broad and representative input. Based on responses to that further opportunity for input, coauthors were added.

There are some potential biases in participation that should be kept in mind in interpretation of the results discussed in the next two sections. Specifically, self-selection may discriminate against participation by those with:
(a) limited access to information and communication technologies—hence against participants from developing countries. This has been recognized by ASB as a real issue for several years, but 47% participation by people from developing countries is an encouraging sign of progress on narrowing the ICT gap.
(b) limited familiarity with modern information/communication technologies—hence possibly introducing an age/experience factor in addition to a developing country factor. Since 59% of participants are ASB veterans, this does not seem to have been a major issue.
(c) busier work and travel schedules. This certainly was a factor, but it is not clear how it might bias results.
(d) less favorable experience with ASB or less enthusiasm for ASB.

This last concern likely is the most serious source of bias in the results of the on-line consultation. Although there is a wide range of experiences, perspectives, and personalities among participants, it is fair to observe that most are ASB "activists" and many could be classed as "enthusiasts". Thus, these results reflect subjective interpretation by a group that probably is biased toward positive assessments of ASB processes. As such, this activity is no substitute for an external, objective assessment of the ASB programme. Nor can it be taken as necessarily representative of the full range of experience of individual scientists who have participated in the ASB consortium.

On the other hand, an analysis based on input from more than one in three of the potential population is far superior to the perspective of an individual or a small group. The use of polls followed by facilitated discussion also helped to structure the discourse in ways that triangulate perceptions of different participants and minimize dominance of any individual view.

IV. Challenges of Integration

Polls and discussions in the first two-week session focused on how ASB has handled the four main dimensions of integration identified in Clark et al 2002: disciplinary integration, functional integration, integration across multiple spatial and temporal scales, and knowledge integration. A fifth dimension, North-South integration, emerged in the discussions. Note: parenthetic references below are to polls and questions; for example (P1/Q1) refers to poll 1 / question 1. Questions and results for each poll are included in the annexes.

4.1. Disciplinary integration

Out of 23 questions in Polls 1 and 2, there was either consensus or broad agreement on 11 of them. Noteworthy areas of consensus include the role of dialogue and collaboration in iNRM research (P1/Q1) and need for a multidisciplinary approach to tradeoffs analysis (P1/Q5). There was overwhelmingly agreement that a clear problem definition is key to multidisciplinary success (P2/Q9) and of the value of joint field visits and benchmark sites in achieving disciplinary integration (P2/Q9,10,11). There also was broad agreement about difficulty in balancing research and impact (P1/Q7), that ASB is a successful example of iNRM (P1/Q9), and that ASB partners share a clear problem definition. These areas of consensus and broad agreement among ASB participants fit well with what other people say about iNRM in general and ASB in particular.

Polls 1 and 2 also included 4 clear cases of divergence in views (P1/Q4,12 and P2/Q5,7). 28% did not agree that a lack of institutional rewards is a barrier for collaboration (which is encouraging, although not the majority view). More disturbing, in light of the broad agreement on problem definition mentioned above is that 37% (8 people) do not feel ASB partners have a shared vision on scientific priorities. The issue of priorities and priority setting recurs below in other dimensions of integration and would seem to be an important area of divergent views that needs deeper investigation.

The polls supported the view that ASB is a successful example of iNRM and participants broadly agreed that a multidisciplinary approach to tradeoffs analysis is key. But questions for more detailed discussion focused on how this success came about: are there 'secret' ingredients to ASB's success or does success in bridging disciplines basically derive from common sense and persistence?

What can we say we've learned about ASB's experience with bridging disciplines?

- The need to forge a "common language" makes cross-disciplinary work more complicated.
- The key to successful interdisciplinary research may rest with defining the question to be answered so that each discipline can contribute to the answer from their own aspect without slipping into researching separate questions.
- When exploring where the discipline comes from to achieve this, participants pointed to the importance of leadership and shared problem identification. Some steps that were mentioned are: 1) collective debate and agreement on objectives and routes to reach them; 2) strong but flexible leadership to keep the team on the agreed path; 3) specialist team members apply their own particular skills to their part of the problem, while remaining aware of the big picture and the ways in which their research interacts with and complements others.

Discussants considered what indicators of success or weakness in integration would be useful for ASB and whether disciplinary integration could be measured. It was posited that convertibility of data units across disciplines (common units) or at least mutual intelligibility is both a necessary condition but also could be one indicator of disciplinary integration. The ASB matrix approach (Tomich et al. 1998) is one such integration tool; various columns in that matrix can be viewed as the domain of a particular discipline and development of methods and measurements often were conducted by disciplinary teams. But each column has units clearly identified, with disciplinary integration taking place across columns that can be understood by various disciplines.

4.2. Functional integration

There was either consensus or broad agreement on 9 of 16 questions in Poll 3 on functional integration, including consensus on ASB's relative success in linking research and policy processes (P3/Q8), on promoting collaboration across government agencies (P3/Q10), and the importance of focusing on users' needs (P3/Q12). In a particularly interesting series, (P3/Q13-16) there was considerable agreement (but not 75%) that tension between global and local issues existed initially, but no clear agreement on whether or not this had declined (14/24 – 58%) neither agreed nor disagreed). However, there was consensus that ASB's governance structure, the Global Steering Group, helps address these tensions through a balanced representation of institutions from 'North' and 'South'.

There were 4 cases of very strong divergence of perspectives in the poll on functional integration. As with disciplinary integration, shared priorities (or lack thereof) seems to be an issue for further discussion regarding development priorities and outcomes (P3/Q4-5). There also were differences in perspectives about payoffs to engagement with international conventions (P3/Q9) – with 50% favoring more linkages -- and ASB's long term links with forestry and agriculture ministries – with a split between those who may view these efforts as wasted because real power rests elsewhere and those who do not agree.

The importance of long-term commitment to functional integration (integration across institutions) emerged as a key factor during on-line discussion. Functional integration was identified as particularly difficult for ASB given the number of different and in some cases competing institutions involved. The objectives of an institution can be difficult for individual scientists to transcend, and this needs to be taken into account in the planning phase of a project.

The long-term involvement of many ASB scientists and its importance both for functional and disciplinary integration was noted in the discussion, but questions remained: how did this happen, especially since there is nothing to guarantee such commitment at the institutional level and much that would tend to interfere? Participants contributed points about the *spirit* of integration, which emphasized efforts to share problems, knowledge and resources.

How does ASB create a 'spirit' of disciplinary integration? By attracting the right people? By incentives for those people to work together? Other means? One common problem seems be that the scientists involved in ASB projects rarely are full-time on ASB activities; they have many other commitments and demands on their time. Finding the balance to ensure that enough time is available for ASB work is sometimes a problem, and enthusiasm and momentum may be lost as a result. Developing, agreeing upon, and planning research in

accordance with common priorities is not easy given the practicalities that come along with working on external, often short-term funding.

Thus it would appear that this necessary disciplinary integration depends crucially on functional integration (across institutions). Such long-term resource sharing among institutions would appear to require special care – institutional partners (as distinct from individual scientists) will continue to participate and share their resources if they clearly see the purpose and benefits from an institutional perspective. But the knowledge and interest of institutional leaders also can influence integration. In Peru, for example, the new Vice-minister of Agriculture is requesting that ASB Peru scale up its technologies (including agroforestry) because of concern about climate change.

Participants emphasized that the balance of satisfaction among stakeholders could be a very good indicator of functional integration. But questions emerged regarding the evolution of stakeholders' perceptions over time: 1) the need to consider different time lags in satisfaction for different stakeholders; and 2) the turnover of individuals within a stakeholder group may affect the perception of the extent of functional integration.

There was broad agreement in the polls about the difficulty in balancing research and impact. Yet impact in the "real world" ultimately is why ASB works with farmers and national policymakers. Participants were keen to discuss what impact means for ASB and how it can be achieved and measured. With respect to impacts, there was a need expressed to explore ASB's shared priorities (or lack thereof) regarding development outcomes. A deep discussion ensued on ASB's impacts at various scales, and one that has yielded some very interesting insights, including:

- It is important to distinguish clearly between 'progress indicators' and 'impacts'. Impacts are the ultimate indicators regarding progress on ASB goals: reducing poverty, improving food security, enhancing environmental sustainability; these are long term (say a 10 year time frame).
- Discussion focused on identifying tangible impacts of ASB's work, e.g. slowed deforestation at benchmark sites, significantly improved livelihoods of farmers, etc.
- Some of the most important impacts are not the ones that can be readily counted. Real impacts may often be difficult to measure, and may only be quantifiable after many years, but this does not mean ASB should take the easy way out and simply revert to cataloguing progress indicators.
- One outcome on which ASB puts a lot of emphasis is changes in perceptions of options and in land use decisions. ASB's emphasis on knowledge generation aims to create a medium to share alternative individual perspectives (farmers, policymakers, and others). Many of the affected individual perspectives include the ASB scientists themselves. Fieldwork and field visits with farmers often provided the most important insights in how to make research relevant. Questions here include: how to measure or even to "observe" these changes in people's ideas? How can one link these changes to ASB outputs?
- Working with multiple national partners and individuals within these organizations helps assure institutional continuity of ASB. In addition to high-level officials, many younger and mid-level scientists are part of ASB activities. Although heads of organizations may change with the political winds, numerous participants provided a stable foundation to maintain and support ASB related work.

- Liu's (2003) study argues that ASB's pathways for impact are multiplied by disciplinary integration and that this integration also may facilitate so-called 'double-loop learning' across scales of activity.

4.3. Spatial and temporal integration

Echoing what external reviewers have observed about ASB, there was consensus or at least broad agreement in Poll 4 that ASB benchmark sites still are appropriate (P4/Q1) and representative of important ecosystems and problems (P4/Q2-3). However, there was strong disagreement (56%) that the benchmark sites were barriers to spatial integration, which also is a plus for the approach. There was a strong consensus that intermediate scales – landscapes and watersheds – are important scales for iNRM research. There was little agreement on questions about how long ASB took to scale out (P4/Q4) and significant disagreement (28%) that the multi-scale approach required 10 years (i.e. a long time) to implement.

Questions on ASB time frame (P4/Q14-18) produced some very provocative and strongly divergent views. Half of the participants disagreed that ASB is driven by a short-term urge to "get on with it" instead of focusing on future generations (P4/Q14) and this split also carried through on other short term questions about urgency of needs of the poor (P4/Q15) , but to a lesser extent regarding urgency of needs of policymakers (P4/Q16). Interestingly, there was a strong consensus that ASB is driven by short term funding cycles and shifting donor priorities (P4/Q17) and 67% felt that ASB partners lacked tools for medium to longer-term time scales (P4/Q18). So it seems that participants have some issues about temporal integration that merit deeper discussion.

There is support for a forward-looking approach – but in the absence of specific analytical tools, is judgment and intuition enough to guide ASB? And how can we maintain long-term consistency in our approach (what our colleague Tatiana Sa aptly calls 'thematic sustainability') in the face of short-term funding constraints? These issues will be taken up below in section 5.3 on resource and capacity constraints.

The discussion of spatial and temporal integration revisited the initial intent of ASB design (Palm et al. 2000; Sanchez et al. 2004) and considered how these approaches have played out at different ASB sites. The temporal scale was built into the design of ASB in several ways: one by chronosequences (or land use intensity gradients) and the other by the "snapshots" of benchmark sites through remote sensing, and even another through the rotation lengths of the different land use systems. In a similar way, the time dimension was integrated within the ASB design from the very beginning, at the level of decades as well as the yearly, within-cycle scale.

As a consortium of researchers from different institutions working at benchmark sites across the humid tropics, ASB faces some particular challenges in its work. There was discussion of ways the variation among sites can be both a strength and a weakness. It was pointed out that variation is a fact of life for a distributed iNRM project, so the opportunity lies in analyzing the variation as opposed to transcending it. Land use in the forest margins is particularly heterogeneous ranging from pasture and annual crops to perennial monocrops, agroforestry, and forest management. ASB sites were set up to allow for cross-site comparative analysis. To date, ASB has concentrated primarily on national level syntheses. There has been some limited cross-site synthesis on specific themes. ASB MA activities are designed to expand this with the aim of a more comprehensive cross-site synthesis.

As indicated by the polls on spatial and temporal integration, discussion participants supported a forward-looking approach, but also noted a number of constraints to this including short-term funding and the absence of specific analytical tools and capacities within ASB (e.g. in formulation and use of scenarios). However, there are exceptions. For example, the ASB Landscape Modeling project in Cameroon specifically addresses land use projections in space and time. Time is handled through chronosequences over the land use intensity gradient in the benchmark area, and also at a finer scale in land use dynamics (e.g. fallow sequences) in individual villages. Spatial issues are handled at two main scales at present, within individual villages, where many or even all fields are mapped and ownership and use are known, and at the scale of the benchmark site, where land use mosaics, village locations, transport networks, and markets all are mapped, typically using participatory techniques.

4.4. Knowledge integration

Questions in Poll 5 on knowledge integration are closely related to topics that will be taken up below in Part 5 on institutional learning and adaptation and on participation of groups with conflicting interests. There was consensus that natural resource management problems and opportunities must be addressed in collaboration with the people who are directly affected (P5/Q1) and unanimity that local communities can be effective research partners (P5/Q5) and broad agreement (only 1 of 24 respondents disagreed) that local knowledge is an important source of information for ASB (P5/Q4).

There was divergence of opinion among participants on only one (P5/Q2) of the 18 questions in Poll 5. In that case, 6 respondents (25%) disagreed with the statement that "ASB takes a balanced approach to scientific, local, and policymakers' knowledge". This is consistent with the consensus (only 2 of 24 neither agreed nor disagreed) that ASB still needs to develop additional methods and procedures to integrate different types of knowledge (scientific, local, policy) (P5/Q3). Just as participatory methods are used in ASB research to understand smallholders' objectives and constraints, consultation with policymakers also is a hallmark of this client-driven approach to policy research. The focus of consultation is to obtain crucial insights from policymakers about their perceptions of problems, opportunities, and constraints, including institutional mechanisms for policy implementation, in order to guide the iterative process of research to identify and develop feasible policy options. Although there was broad agreement (only 1/24 disagreed) that "Working together, scientists and policymakers can produce better solutions to policy problems than scientists working alone" (P5/Q17), 12% (albeit only 3 respondents) disagreed or strongly disagreed with the statement: "To produce relevant results for policymakers, scientists must engage with policymakers early in the research process" (P5/Q16).

Commitment to and perception of benefits from participatory research involving local people and scientists comes through clearly in the poll results. There was unanimity that "Working together, scientists and local people can produce better solutions to local problems than scientists working alone" – here 88% strongly agreed -- (P5/Q15) and consensus (2/24 did not know) that "To produce useful results for local people, scientists must engage with local communities early in the research process" (P5/Q14). These views are tempered by appreciation that local people, policymakers and scientists all face serious time constraints. Participants felt that knowledge integration is an area where ASB has a lot to offer, as a result of its participatory research with rural communities, experience documenting local ecological knowledge, and innovative work in SE Asia to apply techniques for documenting local

knowledge to other epistemologies, namely "policymakers' knowledge" and "modelers' knowledge". On the other hand, there was broad agreement that "There are important social, cultural and political barriers to interaction between local communities and policymakers" (P5/18).

Participants agreed that dialogue and collaboration play a key role in the success of iNRM work. This led participants to discuss not only *how* to carry out dialogue, but also with *whom* ASB should be dialoguing. This was linked to the poll results on functional integration, with its emphasis on bridging policy and research, and on local and global levels. Building on discussion about multi-disciplinary team leaders, a new thread emerged on the importance of "bridgers". It was noted that these bridging leaders need to bring people together as part of a broader vision, but also 'translate' this vision for the team and outsiders to understand. Such a person doesn't just acknowledge and give space to other disciplinary contributions but s/he actually internalizes and incorporates ideas for different sources and viewpoints and comes up with something totally new. It was recognized that the ASB Global Coordination Office plays a key bridging role, with people who understand and can translate the scientific research for different audiences. Questions that were raised (but unanswered) and that may be worth exploring further include: Does ASB attract (and retain) involvement of its "bridgers"? Is "bridging" innate, or something learned? Does participation in ASB help build this capacity? What more could ASB do to nurture "bridgers" and create opportunities to enhance interactions?

4.5. North-South integration

Although the four dimensions of integration identified by Clark et al. proved very useful in structuring the on-line event, an additional aspect of integration emerged in the discussion that also needs to be considered in the case of ASB: North ("rich", "developed") – South ("poor", "developing") integration. Participants noted that power, access and resource differences are not adequately covered under the existing integration categories. ASB has found it useful to explicitly recognize these North-South gaps regarding access to information (application of information technology), access to funding, and in capacities in integrated natural resource management research, but much remains to be done to close these gaps.

There are, of course, also North-North and South-South integration issues – such as between environment/development interests. In this vein, some participants emphasized the importance of a broader cross-section of institutions in the ASB Global Steering Group (ASB's governing body), since the national agricultural research systems (NARS) can by their nature only represent a slice of "Southern" interests and issues. There was agreement that, as one participant wrote, "having an effective voice in the fate of programs that are potentially so related to people's life helps to build effective participation" but the subsequent discussion on challenges of participation (section 5.2 below) also revealed significant divergence of views on how best to approach broadening stakeholder participation.

4.6. Clear problem definition, but are priorities clear?

Although there was agreement that ASB shares a clear problem definition, about a third of the on-line participants feel that ASB partners do not have a shared vision of scientific priorities. The issue of priorities and priority-setting was a key concern throughout the discussion of integration. In a sense, existence of differences in scientific priorities is not surprising when one considers that the first response of a scientist often will be to frame priorities for work in terms of their own discipline, even if there is a shared understanding of

the problem that transcends disciplines. These differences may stem from possible disconnection between local and global scientific priorities.

Then there is the (frequent) tension between conservation and development priorities, an issue raised by several participants. Balancing the tradeoffs between conservation and human well-being is complicated. Functional integration may be hampered by the narrow structural imperatives (focused missions) of different agencies and institutions that set priorities for their own researchers.

Clear problem definition seems to be the key to integration of scientific knowledge with the problems local stakeholders face at benchmark sites as well as integration across disciplines and across functions (institutions). After achieving a clear understanding of these local needs, it may be easier to integrate disciplines. But then what are the scope and limits of ASB if the consortium really is driven by the needs of the poor? Because of the comparative advantage of ASB partners in research on agricultural development and natural resource management, has ASB been overlooking other "alternatives" for better livelihoods? Early on Beckey Elmhirst's (1997) findings on gender-specific migration patterns from the degraded Lampung site in Sumatra pointed at 'urban escape' and 'Greater Jakarta Garment Factories' as the main 'alternatives to slash and burn', but ASB scientists never found a way to effectively follow up. For most of our partner institutions and for the scientists involved, this level of agility in the response to our target group would take the work too far outside our respective institutional domains (and hence individual 'comfort zones').

Many of the forces driving environmental change and natural resource degradation arise outside the forestry and agricultural sectors (Tomich et al 2004), hence beyond control of officials in those line ministries. Therefore, impact of policy research on the twin objectives of poverty alleviation and improved resource management depends on decisions taken by a wide range of policymakers. ASB has had to develop working relationships with a new set of 'clients.' Similarly, few of ASB's original research partners had capacity or interest in policy research. To fill this gap, ASB developed new partnerships with national organizations active in policy research (including NGOs as well as universities and government research institutions.)

V. Other challenges affecting integration

5.1. Institutional learning and adaptation

This topic was the area of greatest agreement among participants. "Institutional learning" is a process of institutional change and adaptation in response to new information and experiences. ASB is not a "conscious being," but ASB may be said to "learn" through collective progress among ASB scientists in understanding of processes and contribution to knowledge.

5.1.1. ASB learns and adapts

There was consensus (17 of 19 participants, nearly 90%, agreed) that "ASB learns and adapts as an institution; i.e. that ASB priorities change in response to new results" (P6A/Q1). This included consensus that ASB learns and adapts in response to scientific results, lessons of practical experience, and from "our own successes and mistakes" (P6A/Q2, Q3, Q5) and broad agreement that ASB adapts in response to better understanding of users' needs (P6A/Q4).

What indicators can be used to track institutional learning and adaptation? Possible indicators at the institutional (consortium) level include problem definitions, programme priorities, and scientific hypotheses. Taking prevailing scientific hypotheses as an indicator, it can be argued that ASB has gone through at least 3 generations of learning.

Following closely on the UN Conference on Environment and Development in Rio de Janeiro in 1992 (and also derived from Agenda 21), the first generation of ASB could be characterized as "technological optimism". The initial perspective could be summed up as:

> Technological optimism hypothesis (ASB version 1). "Poor farmers destroy the world's tropical forests by applying primitive slash-and-burn methods to grow foodcrops. These unsustainable techniques mine soil nutrients and, ultimately, these poor farmers must move on to clear a new patch of forest, with large negative consequences for the environment. This cycle can be broken through better soil fertility management."

This hypothesis was rejected in the first phase of ASB by studies of forces driving deforestation at the various benchmark sites in the mid 1990s. From these studies, it was clear that, among many other things, smallholder productivity growth (precisely the prescription of the initial phase) could accelerate tropical deforestation by making conversion to forest-derived land uses more profitable. This was named the "Pandora's Box Problem".

Version 2 of the ASB hypothesis, which could be termed the "win-win" hypothesis, elaborated the intensification process and incorporated local institutions, especially those concerned with land tenure and resource access, and national policies, including infrastructure and trade and macroeconomic policies. The notion was that the right mix of technological change, institutional innovation and policy reform at the national level could achieve development with conservation. But this win-win approach to the deforestation problem was rejected by the results of the ASB tradeoffs matrix that emerged in the late 1990s, which revealed strong tradeoffs between local and nation development objectives, on the on hand, and global environmental concerns, such as habitat conservation and carbon sequestration.

ASB now would appear to be in Version 3 (or beyond), where efforts are being made to move beyond assessment of tradeoffs to management of conflicting interests across stakeholders and across temporal and spatial scales. In this "negotiation support" era for ASB, emphasis is shifting from plots and households to landscape level analysis and a new focus on rewarding rural communities for environmental services that are not valued in the market.

With the evolution of ASB hypotheses, there also has been a broadening of perceptions both of the necessary disciplinary base within the ASB consortium and also the range of stakeholders, hence potential participants and users. From the "technological optimism" days, in which soil science, agronomy and other biophysical disciplines predominated, the mix of ASB scientists has steadily grown to include more ecologists, economists, geographers, and other social scientists. In parallel, the set of stakeholders has grown from an initial focus on farmers and NARS partners to include policymakers at various levels, environmental NGOs and civil society groups. In each case, the process has brought in new groups – and broader potential scope -- while maintaining important roles for the original participants.

5.1.2. How does learning occur within ASB?

More than whether ASB learns and adapts – apparently it does – the more challenging and important question is how this happens. Essentially, it appears that ASB creates an environment where individuals learn. There was consensus among participants on all of the poll questions regarding specific elements of learning. Among the five questions, the strongest consensus (63% strongly agreed and 26 % agreed; no one disagreed) emerged from the statement that "Long-term involvement of scientists at ASB benchmark sites and in ASB thematic working groups are important elements of relationships that underpin institutional learning and adaptation" (P6B/Q5). This poll did not attempt a comprehensive review of opinions on determinants of learning within the ASB consortium. However, there was consensus regarding all of the following elements regarding ASB:

- Research set in the local reality of ASB sites accelerates learning (P6B/Q1)
- Interaction with ASB users (farmers, policymakers) accelerates learning (P6B/Q2).
- Development and use of quantitative indicators by ASB accelerates learning (P6B/Q3).
- ASB learns from integration of results across benchmark sites (P6B/Q4).

Despite the strong consensus, the discussion revealed some tension between local engagement to frame meaningful research question combined with cross-site syntheses to test broader hypotheses (and produce international public goods). This iterative process of (a) understanding change "on the ground" and (b) putting those observations into a broader context is not straight forward. The tension created between these parallel endeavors appears to be healthy and may well be a key element driving the learning process for individuals and more broadly within the consortium. It was emphasized by several participants that "institutional learning" by ASB as a whole requires investments in "collective learning," meaning opportunities for individual scientists to share information within the consortium. To this end, there were calls for more opportunities for face-to-face interaction among ASB scientists, particularly within regions (Amazonia, Congo Basin, Southeast Asia) but also across regions. Such meetings were relatively common in the earlier years of ASB, but have not been possible to the same extent due to funding constraints in recent years.

5.1.3. Flexibility versus stability.

Clark et al (2002, p. 9) observe that the challenge of institutional learning and adaptation "lies in preserving benefits of durable research programs while introducing incentives for innovation". Participants were unanimous (65% strongly agreed; 35% agreed) that "there needs to be space in ASB for individuals (and institutions) to learn at different rates and to maintain conflicting opinions" (P6C/Q1). Participants' emphasis on the need for flexibility also was reflected in near unanimous agreement (16 of 17 poll respondents) that some flexibility in priority setting is needed to accommodate different views (P6C/Q2). However, there also was consensus (albeit a weaker one) that too much flexibility and programmatic ambiguity can create confusion (P6C/Q3). Scientific rigor was discussed as an effective balancing principle to flexibility in scientific priorities and research methods. On one hand, ASB has benefited from reducing ambiguity and flexibility in sampling protocols – and this has been the basis for subsequent synthesis across sites and testing of generic hypotheses. At the same time, a flexible approach has been essential in the search for locally-relevant solutions and interpretation of global issues at the local level. Put somewhat differently, ASB

847 has attempted to steer a middle path by striving for high scientific standards while being
848 flexible (even opportunistic) about where the scientific results led. It was agreed that
849 flexibility (balanced by rigor) can be a great asset within a long established team. Somewhat
850 more surprisingly, flexibility may also help to ease in new comers to the team – although it
851 probably also requires greater initial effort on their part because research priorities and
852 methods across benchmark sites are not always obvious to newcomers. For the same reason,
853 flexibility in research design also may be something of a liability in conveying ASB
854 messages to an external audience.

855

856 **5.2. Participation of groups with conflicting interests**

857 The greatest divergences in views during the consultation appeared in polls on participation.
858 This may be related to the observation by Clark et al. (2002, p.10) that "there is relatively
859 little understanding of the tradeoffs involved in participation decisions (e.g., how increasing
860 public participation might increase political legitimacy, but might decrease the scientific
861 credibility of the research designed to support the decision making)."

862 *5.2.1. Learning, adaptation and participation*

863 There was (weak) consensus that "Broader participation of different groups in ASB
864 accelerates learning" (P7A/Q1), although 4 (22%) expressed neither agreement nor
865 disagreement with this statement. The ensuing discussion emphasized the importance of
866 viewing participation as a means to specific goals rather than an end in itself. Hence, the
867 need to identify strategic forms of participation derived from prior questions regarding
868 strategic directions and the current stage of development of the programme. Here, the
869 discussion established a strong strategic case for engaging with local communities to gain
870 deep understanding of the ecological basis and rationality of farmers' practices, as this is
871 highly relevant for 'scaling up' to achieve impact of significant areas for significant numbers
872 of people in a reasonable time. ASB results and other evidence suggest that farmers' local
873 ecological knowledge – their understanding of how ecosystem components function and
874 interact – are comparable across similar agro-ecosystems; terminology may vary, but the
875 basic concepts are similar (Joshi et al. 2004). There also was broad agreement about strategic
876 importance of engagement between scientists and policymakers (Poll 5 on knowledge
877 integration, questions 10-12). But, as with rural communities, it also must be recognized that
878 policymakers have many issues competing for their attention and hence little time for
879 attention to scientists (P5/Q13).

880 Too often in international development literature and practice, participation has been
881 misunderstood as simply 'talking to' people. But the ASB consortium has been increasingly
882 creative in engaging with different groups in ways that minimize the costs to them in terms of
883 time and effort. Based on ASB experience, different levels and modes of participation were
884 identified. In Cameroon, for example, ASB researchers actively sought a balance between
885 participation and 'solitary science'. Farmers participated strongly in data collection and
886 quantification of social indicators, including land tenure. Other researchers participated in
887 defining model structure and parameters. The actual model building was largely a solitary
888 process, with periodic interaction and feedback from farmers and other researchers.
889 Continuous participation of farmers and other researchers in the model building process
890 might have resulted in a more "realistic" model, but the extra time required (including
891 participants' time as well as extension of the modeling timeframe) and in model complexity
892 would have been severe. This idea of levels or modes of participation extends to other
893 activities as well (aside from research). Participation can come in the form of specific and

distinct (but not mutually exclusive) roles in governance, collaboration, consultation, and advise or consent, to name a few possibilities. Each of these modes has different costs and benefits and the distribution of these costs and benefits is uneven for ASB and for our stakeholders.

5.2.2. Broadening participation within ASB

There was consensus that "ASB national and local consortia can become vehicles for participation by diverse groups within the countries concerned" (P7B/Q1). There also was broad agreement that ASB, by the nature of the issues it addresses, "often is involved with stakeholders who have conflicting interests" (P7B/Q5)

ASB participants in the consultation either are split on the issue or are of two minds regarding the desirability and feasibility of broadening participation. 11 of 16 respondents (69%) agreed that "ASB should reach out to a wider representation of groups within current ASB countries, including more and different types of local community associations and conservation groups, local government and civic organizations, local and national NGOs, policymakers and other officials at various levels" (P7B/Q2).

But this seems inconsistent with responses to the next question in that poll. Virtually the same number (10 of 16 respondents; 63%) agreed with the statement that "Since ASB collaborators already are overloaded with work, ASB should focus on delivering results for farmers and national policymakers, who are ASB's core stakeholders" (P7B/Q3). This is the only clear case of an institutional contradiction within a poll in this consultation. While some of this apparent contradiction between idealism and realism (or exhaustion) may result from the wording of these questions, it is consistent with the divergence in views regarding the following statements: "There are tradeoffs involved in participation decisions. For example, increasing public participation might increase political legitimacy, but might also decrease scientific output" (P7B/Q4). Nine of 16 (57%) agreed or strongly agreed while 4 (25%) disagreed with that statement.

The discussion of this poll also revealed important differences in perceptions of participation within ASB, which might correspond to different personal or disciplinary perspectives or engagement in different locations or at different times. Moreover, there was no real agreement on means for broadening participation or even whether local participation by poor people in global issues is feasible. For example, over 62% agreed (and the balance disagreed) with a question (P7B/Q6) based on David Kaimowitz's (2003) opinion that "It is still not clear how low income people can participate in a meaningful way in our increasingly global world."

Throughout the on-line consultation, there was a considerable discussion regarding who ASB's stakeholders are. A logical consequence of working on tradeoffs is that ASB is often engaged with stakeholders who have conflicting interests. And it is very easy to significantly expand the range of stakeholders beyond those ASB normally thinks about engaging. Are logging companies and the military ASB stakeholders? Even if these are potential ASB stakeholders, what does ASB do about it? Are they going to be 'satisfied' with ASB's tradeoff analysis? How much effort should ASB put into these groups? ASB has an obligation to make its information available publicly, but how might it proceed in terms of additional outreach efforts? Are there different techniques for different groups? For some, is the only way through national and international regulatory authorities and public opinion? The resource and capacity constraints discussed in the next section have had particular effects on ASB's efforts to address appropriate participation.

5.3. Resource and capacity constraints

There was consensus among participants that despite surviving (even thriving) for more than a decade, ASB has suffered chronic funding uncertainty and funding constraints (P8/Q1). These funding constraints slow progress on training and capacity building (P8/Q3). There also is broad agreement that these constraints also slow scientific progress (P8/Q2). As Clark et al (2002, p. 11) point out, "the challenge is not merely to mobilize more resources and to allocate them … but also to mobilize and allocate in a manner that fosters integration, adaptation and appropriate participation." Existence of an integrated ASB global agenda based on overarching research hypotheses and a clear, shared problem definition contributes to uses of resources that foster integration and adaptation. In turn, this depends on leadership and follow-through from the ASB global coordination office, the Global Steering Group, and regional and national facilitators. Other key elements of this challenge that emerged in the on-line discussion include dissemination of research findings in ways that raise awareness of ASB and long term involvement of certain researchers in all ASB countries. The latter, of course, depends on some long-term consistency in "core" funding which in turn depends on institutional commitment of their institutions. Balanced institutional representation on the ASB Global Steering Group across key institutions and between institutions from North and South is one element in sustaining commitment from partner institutions. Efforts to increase transparency in decision making within the consortium (especially financial transparency) are key to building commitment and trust among partner institutions, particularly to carry ASB through lean years. Expanding, fostering, and deepening appropriate participation – especially at the local benchmark site level and among national partners who have little or no funding "slack" – may be the biggest casualty of funding uncertainty. It is all too easy to raise expectations among local communities and national researchers through consultation and participatory planning of activities, only to have them disappointed if funding for proposed activities falls through or is delayed (as it often is). Once this has happened, it is very difficult to restore credibility of the programme and enthusiasm of the participants.

VI. Conclusions regarding integration to bridge scales and epistemologies

Conclusions are summarized below for each of the 4 areas addresses in the online event. This on-line consultation among ASB scientists proved to be an effective means of identifying areas of consensus as well as divergence in the views of participants in the ASB consortium. In the ASB case, the major topics identified by Clark et al. (2002) are interrelated (Figure 2). The consultations revealed that there are strong interactions between integration *per se* and institutional learning. Both of these depend crucially on participation, which in turn rests on (or is limited by) human and financial resources.

[Figure 2 goes about here.]

Integration

Clear problem definition derived from users' needs is key to disciplinary, functional, spatial/temporal and knowledge integration in ASB. Sustained focus on specific sites facilitated co-location of measurements, which was essential in disciplinary integration. But there also was a social dimension: professional and personal relationships from shared problem focus produce continuity and resilience in scientific teams. In ASB's experience, it appears that functional integration (among institutions) is more difficult that disciplinary integration (among teams of individual scientists). On the other hand, governance by institutions from North and South helps integrate across disciplines and interests – especially the top-down aspects of global environmental concerns and the bottom-up nature of rural development. Boundary roles – communication, translation, mediation – are key to

integration across functions (institutions) and across knowledge systems and arenas (local, civil society, policy, science) (see Figure 3). ASB's global coordination office and its regional and national facilitators play central roles in ASB's functions as a boundary organization (Guston, 2001; Liu, 2003).

[Figure 3 goes about here.]

Institutional learning and adaptation

Clear research hypotheses have accelerated organizational learning and adaptation in ASB. Provisional hypotheses, whether refuted or not, focus efforts on producing relevant evidence and thereby stimulate adaptation. Development and use of quantitative indicators also accelerated scientific learning – especially as they contributed to hypothesis testing -- and facilitated communication across boundaries. Here too, there has been a social dimension: continuity of commitment of lead scientists at specific sites and their involvement across sites and thematic working groups accelerates the learning process and disciplinary integration. ASB's apparent ability to incorporate new partners (at acceptable transaction costs) has facilitated adaptation as new scientific needs emerged. Furthermore, some flexibility in research design is essential to create space for individuals and institutions to learn at different rates. Flexibility also creates space for scientists to maintain conflicting opinions, which can facilitate learning by making possible 'fringe experiments' (Senge 1990). And, as noted above under integration, performance of boundary roles appears to have accelerated learning and adaptation by integrating, translating and disseminating new knowledge across ASB's distributed sites, spatial scales, and disciplinary and functional groups.

Participation

Broad participation of strategically selected groups at different scales with different interests was viewed as a way to accelerate learning. But it also is not feasible to involve "all" stakeholders in a meaningful way, so choices must be made regarding where to invest effort to ensure legitimacy and credibility.

Resource and capacity constraints

Fostering appropriate participation – especially at the local benchmark site level and among national partners – probably has been the biggest casualty of funding uncertainty. While negatively affecting both, funding constraints and uncertainty probably have been more harmful to capacity building than to institutional learning and adaptation within ASB.

In addition to providing insights about ASB processes, these conclusions also could be recast as hypotheses for further testing by other teams. These may hold implications for institutional capacities and processes that will be useful for other research or assessment teams working at multiple scales and endeavoring to bridge different epistemologies.

VII. Acknowledgments

Nancy White of Full Circle Associates developed the on-line environment and provided superb professional facilitation to support the virtual consultation. Funding for the on-line event in November 2003 and January 2004 was provided by the Government of the Netherlands. In addition to the coauthors of this paper, many other ASB colleagues have contributed insights over the years of this collaboration which contributed to this paper. We also wish to acknowledge funding from the Millennium Ecosystem Assessment for ASB MA core activities and support for ASB participants in the MA Workshop on "Bridging Scales and Epistemologies" held in Alexandria, Egypt, 17-19 March 2004.

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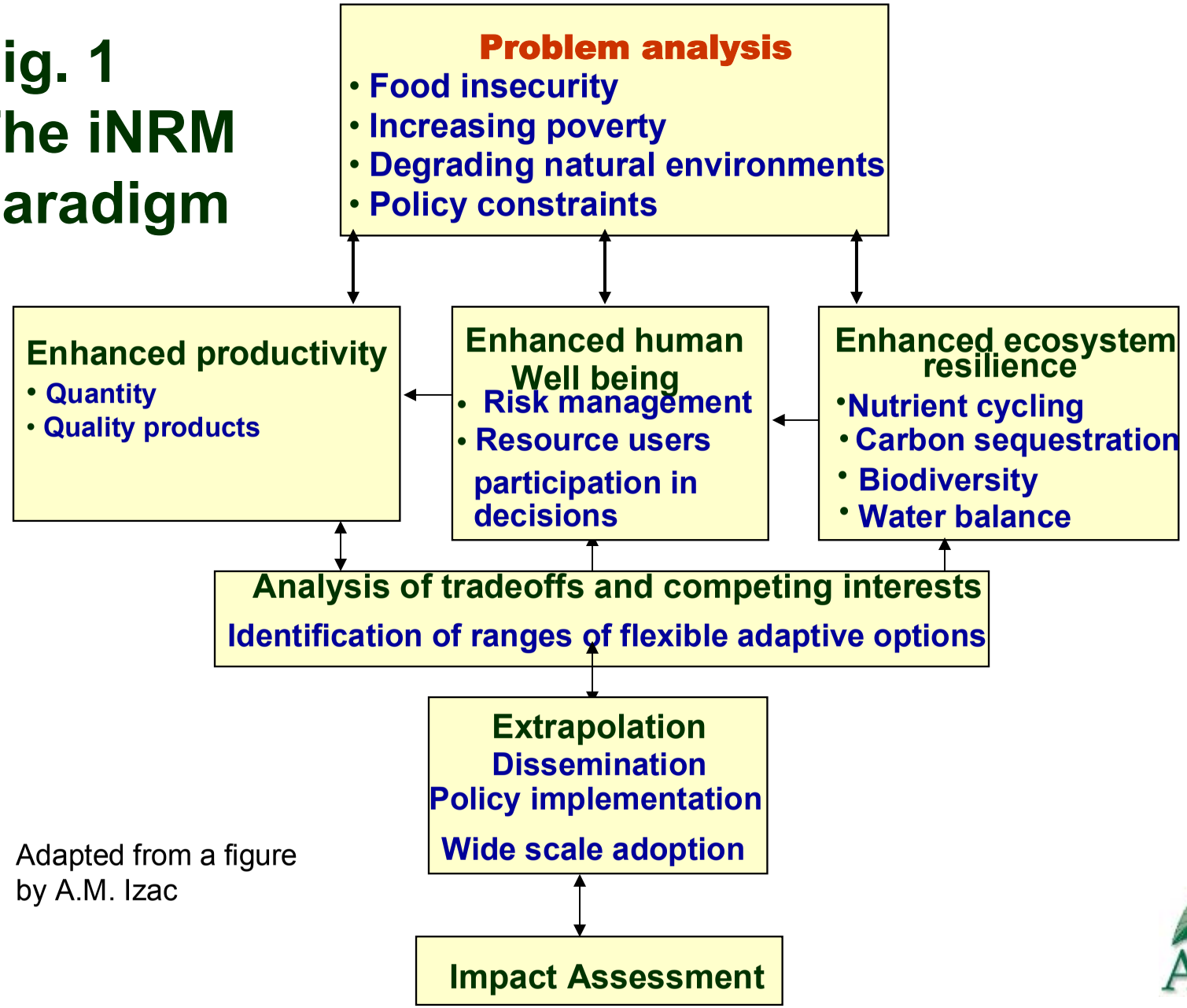
Fig. 1
The iNRM paradigm



Adapted from a figure by A.M. Izac

Figure 2. Analytical Framework

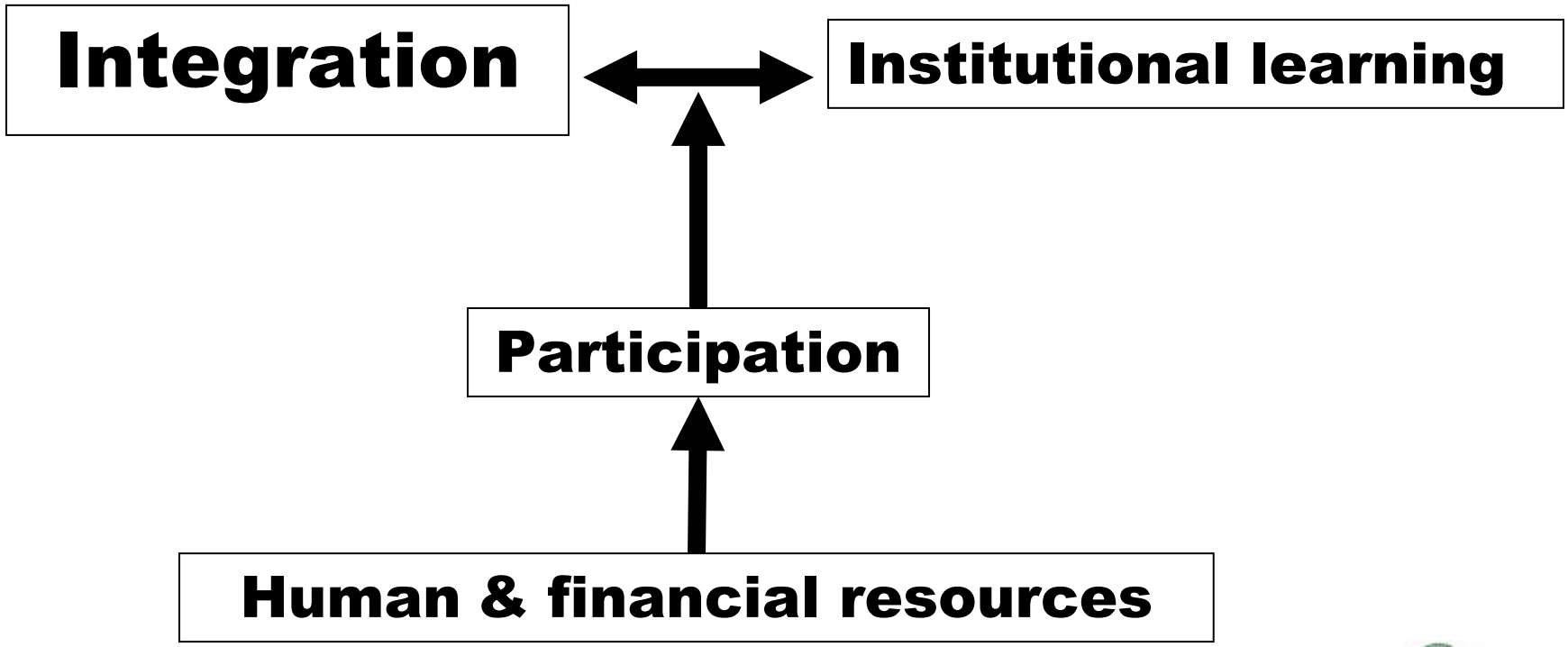


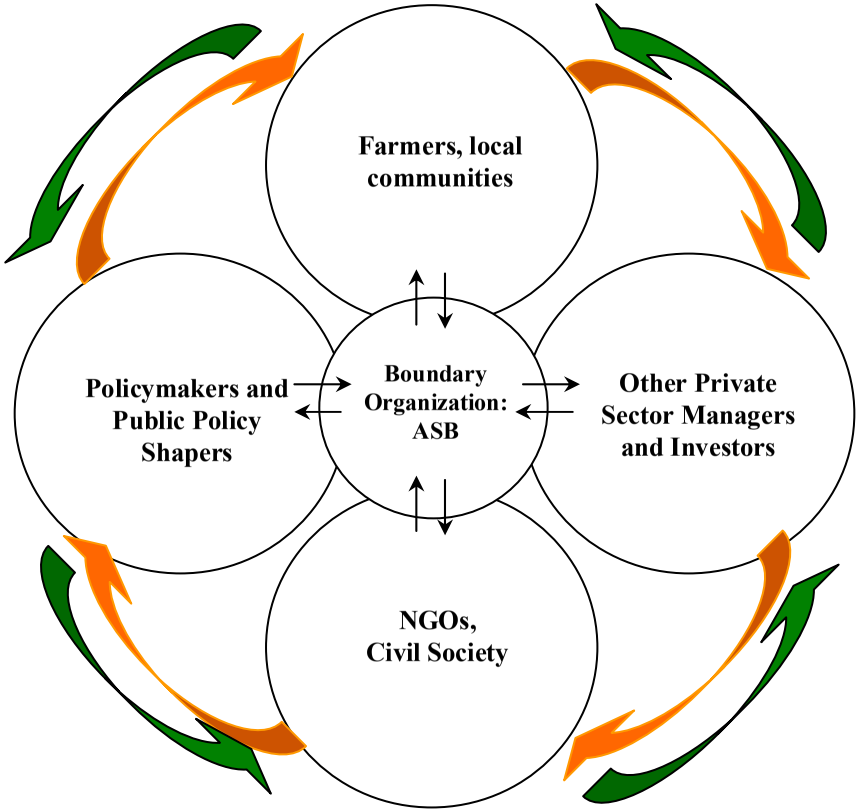
Fig 3. ASB as a 'Boundary Organization' (Guston, 2001)

Characteristics

- Forum for interaction among actors across social arenas
- Attention to managing boundary crossing activities

Goals are achieved through boundary crossing activities:

- **Communication**
- **Translation**
- **Mediation**



ASB