Scand. J. For. Res. 19(Suppl. 4): 5–13, 2004

Taylor & Francis
Taylor & Francis Group

Forest Science and Forest Policy in Europe, Africa and the Middle East: Building Bridges to a Sustainable Future

RICHARD W. GULDIN[1,2], NIELS ELERS KOCH[3,4], JOHN PARROTTA[2,5], CHRISTIAN GAMBORG[4] and BO JELLESMARK THORSEN[4]

[1]Forest Science-Policy Interface, [3]Division 6 – Social, Economic, Information and Policy Sciences, and [5]Division 1 – Silviculture, International Union of Forest Research Organizations, Vienna, Austria, [2]United States Department of Agriculture, Forest Service, Research and Development, Washington, DC, USA, and [4]Skov & Landskab, Danish Centre for Forest, Landscape and Planning, Hørsholm Kongevej 11, DK-2970 Hørsholm, Denmark

Scandinavian Journal of Forest Research

Guldin, R. W.[1,2], Elers Koch, N.[3,4], Parrotta, J.[2,5], Gamborg, C.[4] and Jellesmark Thorsen, B.[4] ([1]Forest Science-Policy Interface, [3]Division 6 – Social, Economic, Information and Policy Sciences, and [5]Division 1 – Silviculture, International Union of Forest Research Organizations, Vienna, Austria, [2]United States Department of Agriculture, Forest Service, Research and Development, Washington, DC, USA, and [4]Skov & Landskab, Danish Centre for Forest, Landscape and Planning, Hørsholm Kongevej 11, DK-2970 Hørsholm, Denmark). *Forest science and forest policy in Europe, Africa and the Middle East: building bridges to a sustainable future.* Scand. J. For. Res. 19(Suppl. 4): 5–13, 2004.

Making forest policies that help to bridge from the current situation to a sustainable future requires sound scientific information. Too often, scientific information is available, yet policy makers do not use it. At a workshop in Denmark, attendees reviewed case studies where forest science influenced forest policies and identified six major reasons for success. Three reasons related to the role of people in protecting, managing and using forests, and ways in which they worked effectively with researchers and policy makers. Three reasons related to the nature of the interaction between the science and policy arenas and the way in which those arenas were organized and functioned. The scientific process is often considered to promote rational thought and exploration of the unknown. An assumption that the policy-making process is equally rational may be unwarranted. Values are central to the policy change process. Thus, scientists who hope to be more effective in spanning the boundaries between the scientific arena and the policy arena constantly have to remember that scientific information in itself is not the primary driver of policy change. *Key words: Forest policy, science–policy interface, scientific community, values.*

Correspondence to: R. W. Guldin, e-mail: rguldin@fs.fed.us

SCIENCE–POLICY INTERFACES

An interface is a boundary between two systems that are often quite different. The nature of the boundary between the systems can have a number of different characteristics. For example, boundaries are sometimes clearly visible with distinct edges. Other times, the boundaries are zones whose edges are blurred or indistinct. Some boundaries are quite permeable, such that things and information flows quickly and easily between the two systems. Other boundaries are relatively impermeable, constricted or restricted, making flows between systems slow or difficult. Where the interface between two information-based systems is relatively impermeable, the information may need to be transformed, translated, interpreted or provided some other form of assistance in moving across the boundary zone.

The boundary zones at the science–policy interface are typically unclear, indistinct zones, often somewhat impermeable to information flows. Within the policy system, policy makers often do not have all the scientific information they desire to quantify potential outcomes and their associated risks and uncertainties. Further, they may see individuals in the science system as unwilling or unable to respond in a timely fashion with data that would strengthen the foundation of the policy-making process.

Within the science system, information relevant to the policy issue may be available, but hurdles within the science–policy interface or misunderstandings about the policy-making process may hinder the flow of vital information from scientist to policy maker. Sometimes, it may be necessary to transform or interpret the information if the information is to flow successfully from scientists to policy makers. Without some form of assistance, the science may never make it to policy makers in time or in the form needed to influence policy. In such cases, the scientists

 ISSN 1400-4089

DOI: 10.1080/14004080410034010

and their science may not be seen as sensitive or relevant to the issues of importance to policy makers. Although some researchers may wonder why their results apparently have little influence on policy making, they may never fully comprehend the reasons and, lacking understanding, have little motivation to change. Other researchers may be oblivious to policy making or invisible to policy makers; consequently, their science rarely influences policies unless some intermediary studies their results and transfers the information to policy makers.

When these situations occur at the interface between forest science and forest policy, frustration often erupts on both sides of the interface. Better ways are needed of sharing information across the forest science–policy interface. Often, neither researchers nor policy makers have the full suite of skills or all the knowledge needed to operate effectively or communicate clearly on both sides of the science–policy interface. Few people exist who can span the boundary between the science and policy systems, people who speak the special languages of both systems. Guldin (2003) outlined the reasons why boundary spanners are few and why information flows across the science–policy interface are impeded.

THE SCIENCE–POLICY INTERFACE: EMERGING LESSONS FROM THE COPENHAGEN WORKSHOP

The case studies presented and discussed during the third regional workshop of International Union of Forest Research Organizations' (IUFRO's) Task Force on the Science–Policy Interface, held in Copenhagen in June 2003, highlighted six broad themes that affect the ease with which information flows back and forth across the forest science–policy interface. Three of these themes had a strong focus on the people involved in protecting, managing and using forests, and their roles in achieving sustainability. The other three themes focused more on the scientific and policy-making processes and the roles and responsibilities of researchers and policy makers in improving information flows across the forest science–policy interface. Each of the six themes is discussed in greater detail in the following subsections.

People's values about forests, and how they protect, manage and use them, should be considered in both planning and implementing research

Several case studies highlighted the roles that cultural dimensions of societies and communities play in creating and shaping public attitudes about forests and their protection. When cultural dimensions were recognized and built into the scientific hypotheses and the alternative treatments to be tested, research results were more credible in the community and provided a stronger foundation for policy making then when the cultural dimensions were ignored. In this issue, Ngobo et al. critically examine previous research programmes concerning natural fallow systems in southern Cameroon, arguing that besides understanding the ecological context, the wider socioeconomic and cultural values of farming communities need to be clearly understood. The study by Flinkman analyses the necessary conditions for a "credible" institutional setting and low-cost transactions for wood supply to construction wood markets in Tanzania and argues that probably the best contribution to socioeconomic development and sustainability should be met under institutional conditions that harmonize with the actors' ideological attitudes and perceptions.

Researchers who invest effort to become culturally aware and sensitive to alternative value systems, to understand the depth of feeling that people have for their forests, have been more successful in seeing their results influence policy and be implemented on the ground. This is illustrated in the study by Mvondo and Oyono on the Dimako council forest in Cameroon in its discussion on how the viewpoints and the needs of the local communities are integrated in the decision-making process.

There is no substitute for scientists and policy makers having a clear understanding about how forests are perceived and valued by communities. This is particularly the case in regions where people are highly dependent on forests to meet daily subsistence needs and/or provide incomes from collection and sale of forest products. In such cases, increasing the ability of forests to sustain the lives of residents is valued as more important than creating or preserving amenity values. The struggle between conserving forest resources and sustaining rural livelihoods is exemplified through the analysis by Ndoye and Tieguhong of the conflict between timber and non-timber forest products in the Congo Basin.

Forest researchers and policy makers who are sensitive to the cultural dimensions and subsistence needs of forest residents and other forest-dependent communities when planning and implementing man-

agement plans will have more success than those who overlook these realities. Indeed, scientists or policy makers who are insensitive to these needs are often seen as arrogant and their proposals are typically ignored.

Local communities are very perceptive about what facets of the forest are important to their quality of life. Often, though, those facets are not neatly summarized for researchers' use. Thus, studies of how communities use forests and the benefits they derive from them can be as important as studies of new protection or management activities. The study by Boon et al. develops an empirically based typology of private forest owners in Denmark to understand the motivations of private forest owners. The main argument is that for policy instruments to be effective, they should motivate forest owners to adjust behaviour in agreement with forest policy objectives. In another qualitative case study by Hansen-Møller and Oustrup, in-depth interviews with 10% of the households next to an urban forest in a Copenhagen suburb focused on the emotional aspects of visiting a forested environment, the types of physical/functional activities pursued and the symbolic connotations of the forest.

Researchers who can accurately evaluate the impacts of new activities and design approaches that minimize or mitigate adverse impacts on those factors that contribute to the quality of life of local communities will be more successful than researchers lacking those skills. The implication for foresters and forestry schools is that they need to reach out beyond the forest sector to understand the cultural dimensions of forests in addition to their ecological and economic dimensions. Further, just as the ecology and economics of forestry change over time, so do cultural dimensions. So foresters need to invest effort over the course of their career in staying abreast of how cultures and values are evolving if they and their work are to remain relevant and credible to communities and individuals.

The values that people – both influential individuals and communities – ascribe to science and the scientific process are important determinants of whether science is seen as credible and a useful basis for improving the quality of policies

In many communities and in many families, traditional ecological knowledge (TEK) enjoys considerable support. For example, in some cultures and communities, management practices are handed down from generation to generation within a family or family group, being faithfully learned and followed by each succeeding generation. Scientific results suggesting that other options be tried or that existing practices are suboptimal may be ignored, because to adopt them would be seen as inconsistent with family or community values, disrespectful of community and family traditions or mores, or in some cultures where deceased individuals are venerated, perhaps even heretical. As a result, insensitive introduction or advocacy of scientific results may impugn the scientific method within these communities or families. Several case studies reported that TEK remains an important basis for managing forests. Ghazanfari et al. evaluate traditional forest management practices and their effects on stand structure in the Kurdistan Province (Iran) to understand better how such practices can be used to meet the diverse forest product needs of local communities and minimize conflicts with the Forest Service. From the same region Pourhashemi et al. recommend complementing traditional forest management practices with modern scientific surveys such as site potential evaluations and classification of Forest vegetation to avoid degradation and as an important step in the development of improved forest management plans in the region.

TEK condenses much wisdom from past generations. Learning how to expand and deepen our current understanding of that wisdom is a key challenge, both for researchers and for policy makers. Developing ways of integrating TEK with knowledge developed using the scientific method is an ongoing challenge, one that must be adapted to the cultures and communities where the TEK resides.

Conflicts often arise between traditional uses and new uses of forests. In developed countries, the conflicts may be driven by, among other things, changes in technology or consumer preferences. In less developed countries, conflicts may be driven by the same changes, but the approaches to resolving the conflicts that work well in developed countries may not work so well in less developed countries. Conflict resolution approaches should always be tailored to the situation. Mvondo and Oyono report, in their study of forest co-management, on community-based social negotiation tools which have not been recognized until now by "normal science", forestry experts and policy makers in Cameroon. Conflict resolution approaches need to be carefully designed to be "fair" in the sense that cultural values and traditional knowledge are

respected in the conflict resolution process and not "trumped" or "vetoed" by scientific information. If scientific information or the scientific method is seen as disadvantaging traditional knowledge or cultural values, then the local community may reject the scientific method and a conflict resolution process based on scientific information may be perceived as unfair.

Science should reflect the breadth of public values. If hypotheses are too narrow or one-sided, if they do not include or respect TEK or community values, then the public will not accept the results or policies based on those results. When implementing the scientific method, scientists should seek the participation of local communities in designing the experiments. Further, scientists should take positive steps to honour and respect the community's views throughout the research process and even into the policy-making process. This requires scientists to have a cultural and political astuteness for working with people from different backgrounds and cultures, and an understanding of how to incorporate the views and values of outside parties into the scientific process. By turning participants into stakeholders, the credibility of science and the scientific method is enhanced.

The values that people – both influential individuals and communities – hold regarding the protection, management and use of forests are important determinants of whether policies are seen as credible and a useful basis for improving the quality of people's lives

Two different types of community are very important to the policy-making process: communities of place and communities of interest. A community of place is a village, town or city; a specific geographic location where people of diverse viewpoints and values live their lives. The aggregate views of the residents in a community of place form a set of values regarding forests near the community. In contrast, a community of interest is a group of people who share similar values but are geographically dispersed. An organization is an example of a community of interest. People join an organization because they share the values espoused by the organization.

In many of the case studies presented at the workshop, communities of interest outweighed communities of place in the political struggle for acceptance and influence in policy making. Masozera and Alavalapati argue in their case study from the Nyungwe Forest Reserve, Rwanda, that conservation of biodiversity in protected forest areas will be more challenging if local communities are heavily dependent on them for energy, nutritional, medicinal and other subsistence needs. In a completely different part of the world, Jensen and Koch show, in their study on 25 yrs of forest recreation research in Denmark and its influence on forest policy, that society is prepared to bear relatively high costs to cater to the public need for outdoor activity.

Key questions that surfaced in several of the papers were whether it was fair for one type of community to be more influential than others, and what role science and scientists have in creating a "level playing field" where communities of place could enjoy equivalent influence.

Ongoing multi-stakeholder processes that bring government representatives and non-governmental organizations together in focused dialogues about the future of forests are very valuable in building trust and knowledge essential for developing and implementing effective policies. In his study of bark harvesting for traditional medicine in the Umzimkulu forests of South Africa, Geldenhuys documents an effective strategy for moving away from illegal resource degradation towards sustainable participatory forest resource management.

In most societies, governments are the ultimate expression of the aggregated values of both communities of place and communities of interest. Most of the tension encountered by governmental policy makers revolves around the balancing of interests among communities of place (constituents organized geographically) and communities of interest (constituents organized by shared values). Often, the communities of place, with their diverse suites of values, are less well organized and lack a common voice, so their interests are not so clearly heard by policy makers.

Communities of interest are better organized and have a unified common voice, so their interests are more clearly heard by policy makers. Multi-stakeholder dialogues where the range of communities of place and interest are well represented can provide a more useful forum for exploring policy options and building support than other ways of assessing public support and values. In particular, multi-stakeholder dialogues can help to level the playing field by providing all representatives with the same data concerning forest conditions and trends. Common knowledge about forest conditions and trends forms the best basis for informed dialogue about desired

future forest conditions, the various values associated with alternative futures, and the management options, their likely effects, risks and uncertainties that provide alternative pathways towards the desired futures. Frank, open and respectful dialogue where all points of view can be discussed and different values can be explained build group wisdom and support – the trust – essential for effective policy making and implementation.

The impetus for changing policies typically arises from two situations: either values change or forest conditions change in ways detrimental to current values. In either case, values are central to the policy change process. The key point is that scientific information is not the primary driver of policy change. Rather, scientific information is at best information that illuminates the fact that values are changing or that forest conditions are changing. For example, science may shed light on how risks or uncertainties previously accepted by policy makers are changing (a change in values), or show that new options for mitigating environmental changes detrimental to current values have been discovered.

The role of new scientific information is primarily reshaping the foundation for dialogue about policies – a second order effect on policy development – rather than forcing policy change. Kojwang concludes in his case study that in southern Africa, forest policies have been influenced by national macroeconomic policies rather than developments in forest research. He recommends that countries ought to foster research–policy interfaces by deliberate design such as those provided by natural resources forums, working groups, specialist networks, and similar structures and institutions.

In nearly all case studies examined, other information besides scientific information was an important component of a policy decision. Suggesting that scientific information alone drives policy change indicates an incomplete understanding of the policy-making process.

How scientific results are disseminated is a key part of influencing policy. While peer review is a necessary precursor to effective information dissemination, it is not sufficient. Targeted, tailored, translations of results must be prepared to reach policy makers

A message heard repeatedly at the workshop was: know your target audience to select an outreach method and tailor the message so it appeals to the audience. Policy makers are often attempting to deal with a large number of unruly issues simultaneously. Rarely do they have the time for or the luxury of learning a great many facts and all the facets of an issue. So all the facts and facets of an issue must be condensed to a vital few points and simple, straightforward messages about them prepared. As Konijnendijk, in his study on urban forestry in Europe and North America, points out, "knowledge brokers" have started to play an important role where networks of urban forestry policy makers, managers and scientists have been instrumental in defining research needs and where embarking on strategic alliances with other disciplines and professionals has proved successful. Policy staff normally do this hard work of condensation and preparation. Staff members often are very astute politically and understand community values and social aspects of issues very well. What they lack is an understanding and appreciation of the scientific information.

Scientists who are both good listeners and good presenters are needed. Listening is the important, often overlooked, first step for scientists. Scientists need to listen carefully to the policy makers' and their staff members' descriptions of the issue, for in that description lie kernels of wisdom about what values are influencing the policy process and what perceptions, accurate or not, exist. Only after listening carefully can the scientist begin to assemble the information pertinent to the policy decision and organize it into a simple, concise presentation for policy staff, who are often the primary audience. Bytnerowicz et al. report on the experiences within the Czech Republic, Poland, Romania and Slovakia, where forest scientists and management have developed more effective collaboration, discussing ways to disseminate information about major scientific accomplishments that may have important implications for management practices and policy making.

Some scientists misunderstand their role in the policy process. Their role is not to become an advocate for a particular viewpoint. Becoming an advocate usually has a negative effect on the credibility of a scientist's results, because advocacy is equated to being biased in favour of the particular viewpoint. Advocacy is best left to others.

Scientific organizations are more influential in policy discussions when they have flexible and resilient programmes that combine a long-term vision with delivering relevant results in the short term and when they emphasize the importance of interdisciplinary research

To play a constructive and effective role in policy development, scientific organizations must have the capability to anticipate future changes. Scientific organizations must be forward looking. They must be able to provide early alerts about emerging issues and potential changes in resource conditions, economies, and societies, and values. Beyond just signalling that certain changes may occur, scientific organizations must be able to launch studies and generate results far enough in advance to provide the basis for policy responses to the changes before negative impacts become insurmountable.

Scientific organizations that have been adept at anticipating the future are those that have flexible and resilient research and development programmes with both a long-term vision and the ability to deliver relevant short-term results. Flexible and resilient organizations are able to adapt easily to changes in priorities as issues emerge and potential changes are identified. They have a broad array of expertise in their scientific cadre and a strong network of partnerships with other research organizations to augment their in-house talent, which contribute to resilience. They also control their staffing and overhead costs to ensure that sufficient operating funds exist to move quickly into new research studies. They set clear expectations for their researchers that changes in research priorities will occur and rapid responses are necessary. Keeping reasonable operating budgets and creating the expectation that changes in research focus will occur contribute to flexibility.

Scientific organizations with a long-term vision that are also able continuously to deliver short-term relevant results are most influential. The ability to deliver short-term results without a long-term vision leads to a lack of focus and the sense that the organization is adrift on a windy sea, heading whichever way the wind blows. That detracts from credibility and trust. Focusing so intently on long-term objectives that useful results are not delivered that respond to current issues makes an organization irrelevant. A balanced blend is essential. An organization must have sufficient long-term vision that emerging issues and changes in values rarely take it by surprise and that complex issues taking a long time to solve can be studied efficiently. An organization must also have the capacity to respond to contemporary issues through ongoing applied research and development activities. In short, the best scientific organizations are adept at both strategic and tactical issues. Continuing political and financial support also depend on maintaining the right blend of these capabilities.

The most pressing and most interesting forest policy issues today are those responding to complex problems having many facets. To be successful, research teams studying complex problems need experts in different disciplines so that work can proceed simultaneously on the many different facets of the problem.

Research administrators have advocated multidisciplinary teams for some time, but have frequently defined too narrowly the spectrum of disciplines needed. For example, it has often been recognized that complex watershed issues require expertise beyond hydrology. Yet in thinking about the other disciplines needed, limiting the spectrum to other ecological (e.g. silviculture) or biophysical (e.g. soils, water chemistry or soil microbiology) sciences may be too narrow. To apply research results at spatial scales above the stand level often requires expertise from the economic and social disciplines. More recently, information management expertise (e.g. geospatial and remote sensing) is becoming of increasing importance. The study by Strange et al. on biodiversity conservation in Danish natural forests recommends an interdisciplinary approach, but cautions that the integration of economics and biodiversity information leads to a trade-off between potential costs in the design of reserve networks and species survival.

Further, ideas on how these skills should be deployed have been changing. In the past, team members met occasionally to co-ordinate their activities. Outside the team meetings, the experts tended to work by themselves on their own distinct tasks. This led to results that were somewhat separable (silviculture findings for the silviculturalists), with some consideration of the spillover impacts in other areas (that the recommended harvesting approaches would generate soil erosion impacts of a certain level, and the soil scientists would then propose activities to mitigate adverse impacts). Each expert was responsible for a relatively distinct subset of the overall set of recommendations. The notion of integrated results was more a thin veneer, covering a set of relatively distinct and separable modules of recommendations by scientific discipline, than an integrated approach from top to bottom. What is needed for future research is an approach that is more tightly integrated from the start, involving more than just co-ordination. The experts need to work together more as a team, collaborating

and co-operating instead of just co-ordinating. Results from this approach will be much better integrated and much less separable into disciplinary modules. The team would be responsible, as a group, for the set of recommendations rather than just a subset of things pertaining to their expertise

Choosing, organizing and leading an interdisciplinary team requires special skills. It takes more than a great scientist, it takes a person with strong people skills to coach, mentor and blend the diverse talents and backgrounds of individuals into a smoothly functioning, well-integrated team. This is particularly true where the research organization responsible for the study lacks some of the necessary expertise and those skills are acquired from other agencies or organizations through partnership agreements or contracts. In this situation, the need to work across organizational cultures is an added challenge.

Several case studies illustrated the point that interdisciplinary research is becoming critical to success, that the array of skills needed to attack complex problems is broader today than it has been in the past, and that the team leadership skills needed to work across organizational boundaries are important (see Strange et al. and Bytnerowicz et al.). Discussions at the workshop emphasized that the importance of these factors will increase in the future.

Forest research institutions that are seen as independent, neutral and unbiased are more effective in spanning the boundaries between science and policy than research institutions that lack these characteristics

A particularly strong conclusion of the Copenhagen workshop was that the organizational structure and independence of the research enterprise has a strong influence on the credibility and standing of forest research in the policy arena. The task force's earlier (2002) workshop in India came to virtually the same conclusion.

The concept of independence means that the researchers are free to draw whatever conclusions their data suggest and to report their results without being censored or pressured by policy makers to alter their findings. Mayer and Rametsteiner give an example of a fruitful interface between policy makers and science in Europe. They conclude that, since its establishment in 1990, the Ministerial Conference on the Protection of Forests in Europe (MCPFE), an international policy-making platform on forest policy in Europe with 44 European countries, has provided an active interface for bringing the results of independent forest science to European forest policy deliberations.

When policy makers direct what the results should be, often to buttress previous policy decisions or predilections, researchers have lost their objectivity. Losing objectivity leads to loss of credibility and trust. Not only are these losses attached to the results of a particular study or the particular researcher who conducted the study, the losses in credibility and trust are attached to the entire research organization employing the individual. Therefore, the loss of independence in a single study has a widespread and long-lasting effect on the credibility of the research organization. This negative effect on the institution's reputation can spread well beyond the particular research field. Loss of objectivity by a university forestry student or faculty member can affect not only the forestry school's reputation, but also the reputation of the entire university. Similarly, loss of objectivity by a government agency researcher can affect the reputation of all the agency's programmes and even undermine public trust in the current government administration or in government as a whole.

Trust and credibility are the accumulated perceptions of many people over long periods. They are slow to accumulate, over years and decades, and easy to tear down, often through a single study. Therefore, forest researchers and research administrators as well as forest policy makers must take special care to conserve and protect trust and credibility. Both groups have special roles. Researchers and research administrators should ensure that the whole scientific process is followed. Peer review is the most widely accepted and effective approach for independently validating the reasonableness of a study's findings. Researchers should also avoid becoming advocates for particular policy positions and administrators should rein in researchers who stray over the line and become advocates. Advocacy is inconsistent with objectivity. Policy makers should limit their influence to calling for research studies and helping to shape the hypotheses to be tested, but should then assume a hands-off position until after the conclusions have been drawn and passed peer review. At that point, the results can be considered, along with other information, as part of the policy development process. Any attempts to interfere with research studies and preordain what the results should be will inevitably lead to loss of objectivity, and negatively impact the reputation,

credibility and trust of the public in the researcher and their institution, and ultimately the policy maker too. Peterson and Shriner, for example, conclude in their study on the National Acid Precipitation Assessment Program (NAPAP) in the USA that current policy development needs are taking a cue from the experience of the Forest Response Program (under NAPAP) by recognizing the critical role of a strong science foundation in establishing the credibility necessary to inform all interested parties in the policy debate.

Within individual countries, there are steps that the forestry community can take to increase the credibility and trust placed in their forest research institutions. In the discussions following the presentations of several case studies, examples were provided of national councils or roundtables of forest stakeholders that have successfully elevated the standing and prestige of forest research within federal and state governments. Stakeholder groups can also prove effective in providing support and political cover for research and development on institutional arrangements, policy-making structures and governance issues that the research institutions by themselves may not be able or willing to undertake without this external political support. Instances were cited where ineffective policies had their genesis in ineffective or inappropriate policy-making processes or institutions, and where research into alternative processes and institutional structures led to overall improvements in policies and ultimately public satisfaction with changes in forest conditions, as in the study by Flinkman.

Finally, cases were cited where institutional arrangements were ignored or neglected during periods of dynamic change, more typically radical or revolutionary change rather than evolutionary change. In their study on international assistance to the Lithuanian forestry sector, Brukas and Hjortsø conclude that the rapid change in the institutional context requires an additional effort from donor agencies to learn and adapt to new settings. This is a strong argument in favour of more active collaboration with local stakeholders combined with a flexible use of project management methods.

Failing to consider or account for institutional arrangements when planning or conducting research, or worse, when developing policies, can lead to situations where the self-interest of individual parties is elevated *vis-à-vis* the interests of communities of both place and interest. The time is past when social and economic systems, where institutions typically operate, can be overlooked and only elegant ecological solutions can be proposed. The likelihood of success in both the research and policy-making processes is greatly enhanced when institutional arrangements are fully integrated into the processes. The likelihood of success grows even further when the full suite of considerations from the economic and social systems is integrated with the ecological system considerations in the research and policy-making processes.

CONCLUSIONS

A common thread running through the six broad lessons discussed above is that both researchers and policy makers continually need to reassess long-held assumptions. Of particular importance are assumptions about forest conditions, about public values, and about the effectiveness of management activities and past policies in influencing forest conditions and serving public values.

Sound resource inventory information is needed about the conditions of forests and recent trends. Trend changes are often evolutionary rather than revolutionary and only dedicated programmes that remeasure and reassess conditions periodically over time can provide early warnings of undesirable changes when they are easiest to mitigate. This means that countries should invest in inventory and monitoring programmes that make and keep current assessments of condition as the foundation for forest policy making. Making policy without information on the current conditions and recent trends in forests is fraught with danger.

Evaluating and testing current assumptions are vital steps to becoming a learning organization. Results of the research and policy analyses may validate these assumptions. The results may also suggest adjustments or alternatives that need to be considered. Public values can change as well as forest conditions, and both types of change warrant a re-examination of past management actions and policies to determine whether they should be continued or adapted to the new situation. Research institutions have a vital role in helping to illuminate the impact of policy changes on forest conditions and public values, and providing a feedback loop to both policy makers and scientists. Sometimes, these impacts must be traced through second and third order impacts and other systems and sectors to track their ultimate and cumulative effects.

A second common thread is that people are important: people who live in or near the forest and

use it for various purposes as well as people who care about the forest from afar. People and the values they hold regarding forests should play a more central role in future research and policy development to align management priorities and policies with public values. Balancing among communities of interest and communities of place is important to the success of both research and policy making. This suggests that researchers need to understand the workings of economic and social systems as well as ecological systems, because these three systems are inextricably linked and actions in any one will inevitably affect the other two.

Thirdly, the importance of moving from a multidisciplinary to an interdisciplinary approach to research cannot be overemphasized. Interdisciplinary science teams are essential for today's complex regional and global issues, and will only become more so in the future. Team members need to be assembled from all three systems – ecological, economic and social – to provide the diversity of expertise needed. Further, most of the issues are so complex that it will typically take a decade, or longer, to study them fully. This means that provisions are necessary to avoid losing momentum when people leave early or come into interdisciplinary studies midstream. The days of the lone researcher are past. The days when a single institution can successfully take on complex issues are also rapidly waning. Institutional and national capacities to conduct research need to take these interdisciplinary needs into account and restructure themselves accordingly to take a more networked approach to future research and policy initiatives.

One of the challenges for IUFRO is to share its success stories of working across cultures: not only organizational cultures within a country, but also organizational and social cultures among many countries. The need to strengthen capacities to conduct interdisciplinary research effectively across national borders as well as disciplinary and organizational boundaries is becoming increasingly important as complex problems grow to global proportions. IUFRO has more than a century of experience in building transboundary and transorganizational networks of researchers. Within the past decade, IUFRO has recognized the importance of providing leadership within the forestry community on modelling the new interdisciplinary research approaches needed through the formation of task forces that integrate across disciplines more effectively than was possible within the traditional discipline-based divisional structure.

Finally, although the design of the scientific process is intended to promote rational thought and exploration of the unknown, assuming that the policy-making process is equally rational may be unwarranted. People who successfully span the boundaries between the scientific arena and the policy arena have learned to live with this dichotomy. That does not make one right and the other wrong. It just makes them different. Scientists who hope to be effective boundary spanners between forest science and forest policy need to learn how to celebrate the differences between the two.

REFERENCE

Guldin, R. W. 2003. Forest science and forest policy in the Americas: building bridges to a sustainable future. For. Policy Econ. 5: 329–337.