

# Evaluating environmental policy integration and policy coherence across service sectors: The case of South Africa's inland water biodiversity



Nikki Funke and Dirk Roux (1)

## ABSTRACT

*The conservation of South Africa's inland water biodiversity has until recently only been incidental to the formal protection of terrestrial ecosystems. As a result, only 50% of the main rivers contained in South Africa's protected areas are ecologically intact and 54% of main river types outside of or bordering protected areas are critically endangered. This article reviews the Water Research Commission (WRC) project that has facilitated the development of cross-sector policy objectives to enable the inclusion of the systematic conservation of inland water ecosystems in the strategic planning processes of several sectors impacting on South Africa's inland water biodiversity. The authors use environmental policy integration (EPI) research approach to analyse the rationale and process whereby the cross-sector policy objectives were developed. The focus then shifts to the limitations and successes of the process and suggestions are made about how implementation of the cross-sector policy objectives at both the local and national level could be achieved.*

**Keywords:** Inland water biodiversity, conservation, cross-sector policy objectives, South Africa, ecosystems, environmental policy

## 1. INTRODUCTION

The conservation of South Africa's (and indeed the world's) inland water biodiversity (2) has generally only been given consideration to the extent that they incidentally form part of formally protected terrestrial ecosystems (Abell, et al. 2007: 50; Skelton et al. 1995: 71; Roux et al. 2008: 100). Not surprisingly therefore, most riverine ecosystems are not represented in protected areas and even where rivers fall within protected areas, conservation is still not necessarily guaranteed. In fact, only 50 per cent of the main rivers that are contained within protected areas are ecologically intact as a result of being negatively impacted by external activities, such as, dam construction and agriculture (Nel et al. 2007: 346). In addition, an assessment of the ecosystem status of South African rivers outside of or bordering protected areas has revealed that 54 per cent of main river types are critically endangered. This situation is very grave as the conservation of inland water biodiversity is critical to maintaining the natural functioning of freshwater ecosystems and the important services they provide, especially to poorer people who are directly dependent on them (Nel et al. 2007: 346).

Biodiversity conservation calls for the setting aside of representative examples of ecosystems to act as 'biodiversity banks' to serve as proactive protection against potential future modifications. Such conserved areas are then regarded as resources for allowing future generations to partake in the current biodiversity heritage and creating benchmarks against which human modification of ecosystems can be measured in the long term (Roux et al. 2006a: vi). Arguably the most feasible management solution to effect the systematic and purposeful conservation of inland water biodiversity, which is also conducive to sustainable development, poverty alleviation and enhanced human well-being for all South Africans (Roux et al. 2006a: v), is integrated river basin management (IRBM) within catchments. IRBM takes into consideration the inter-linkages and dependencies between water, the biophysical environment and socio-economic and political factors. IRBM plans need to develop clear and explicit conservation visions, targets and guidelines to ensure the sustainable management of inland water ecosystems and the services they provide (Gilman et al. 2004: 2; Nel et al. 2007: 348).

Because water is a cross-cutting issue, conserving inland water ecosystems and inland water biodiversity requires substantial co-operation between the agencies responsible for other sectoral policies that affect or are affected by water. These include agriculture, housing, urban development, rural development, health, economic development, environment and so on (MacKay & Ashton 2004:1). In 2005 South Africa's Water Research Commission (WRC) recognised this need by initiating a project that has facilitated the development of cross-sector policy objectives to enable the inclusion of the systematic conservation of inland water ecosystems in the strategic planning processes of several sectors impacting on South Africa's inland water biodiversity (Roux et al. 2006 a).

This article makes use of an EPI research approach (Persson 2004) to analyse the rationale and process whereby the cross-sector policy objectives were developed. The focus then shifts to the limitations and successes of the process and some suggestions are made regarding progress towards the future implementation of the cross-sector policy objectives at both the local and national level.

## **2. DEVELOPMENT OF THE CROSS-SECTOR POLICY OBJECTIVES**

### **2.1. Environmental policy integration**

The term policy can be defined in numerous ways (de Coning 2006: 11), adding to the complexity of studying what it entails and what it aims to achieve (Persson 2004: 10). For the purposes of this article, policy is defined as ‘a statement of intent’ and specifies ‘the basic principles to be pursued in attaining specific goals’ (de Coning 2006: 3). While the term policy is not necessarily limited to the political sphere, *public* policy necessitates government involvement and direction and can be defined as ‘the combination of basic decisions, commitments, and actions made by those who hold or affect government positions of authority’ (Gerston 2004: 5). In most cases, public policy is made as a result of the combination of interactions between people or groups who demand that a certain change take place, those who are tasked with making decisions at the national political level and those who are affected by the policy in question. It can also be seen as a dynamic and continuous process that is constantly subject to ‘re-evaluation, cessation, expedition or even erratic movement’ (Gerston 2004: 5).

The term ‘integrate’ has several possible meanings including ‘to form, co-ordinate, or blend into a functioning or unified whole; to unite with something else; to incorporate into a larger unit’. This suggests that integration can mean combining several parts into a new greater whole and incorporating one part into a larger already existing unit at the same time. What also emerges here is the question of hierarchy and priority among the different parts that are to be integrated (Persson 2004: 10).

The concept of environmental policy integration (EPI) can be widely interpreted and literature pertaining to it suggests an extensive range of different strategies, measures and criteria to achieve integration (Persson 2004: 42). The various definitions and interpretations of the concept allow analysts to decide whether EPI represents a normative or rational policy objective and whether it should be analysed as a policy process or output. Based on these choices a focused definition of EPI, that is particular to the case study that is to be analysed, can then be formulated. Related to such a definition various other conceptual issues can be seen to play a part. These include:

- the ultimate objective of EPI (environmental protection within an overarching focus on sustainable development)
- the fact that the inland water conservation objectives were formulated by taking into account the activities of several sectors (sector integration)
- the form that policy integration took: a set of common or consistent policy objectives; and
- how to consider the influence of different levels in the policy system (international, national, regional and local) on the achievement of EPI (Persson 2004: 44).

### **2.2. Policy coherence and the development of cross-sector objectives for conserving South Africa’s inland water biodiversity**

South Africa is a signatory to several international and regional policies and treaties relating to the conservation of freshwater ecosystems. This commitment requires that all organs of state

should take on the associated responsibilities and implications associated with adhering to international law. When policy is cascaded down from the international to the national context, especially as far as a cross-sectoral issues are concerned, close attention should be paid to policy coherence, which has both a vertical and a horizontal dimension.

Vertical policy coherence means that local and provincial authorities need to develop policies that are aligned with and support national policies, whereas horizontal policy coherence calls for achieving a complementary consistency of policies across related sectors at any given level. Inland water biodiversity, for instance, requires coherence in the objectives regarding land use and ecosystem protection across the water, health, biodiversity, environmental management and agricultural sectors (Roux et al. 2006a: ix). According to the OECD (2003: 2), policy coherence can be defined as ‘systematic promotion of mutually reinforcing policy actions across departments and agencies to achieve agreed objectives’, which coincides with Roux et al.’s definition of the term.

The definition of integration for the purposes of this article, as given above, coincides with these definitions of coherence. In addition it adds another dimension as it not only refers to co-operation to combine several parts of existing policies into a new greater whole, the overarching goal for conserving inland water biodiversity in South Africa and related cross-sector policy objectives, but also refers to integrating the new goal and objectives into the strategies and plans of the different sectors that participated in the process.

Since 1994, South African government policy has consistently focused on equitable and sustainable social and economic development to benefit all South Africans. While several of the principles present in the policies of the water, environmental, agricultural and land planning sectors share a common philosophy and adhere to the requirements of South Africa’s Constitution (3), thereby supporting the development of a cross-sector policy for the conservation of inland water biodiversity, the necessary next step is to develop shared operational plans, objectives and approaches that fall in line with this common philosophy and promote closer alignment between the different sectors (Roux et al. 2006a: ix; de Coning, 200x: 14). This is of particular importance as the separation of line functions between different government departments (e.g. water, agriculture, land) complicates the attainment of proper levels of alignment and coherence between their separate but inter-dependent mandates (MacKay & Ashton 2004: 3). Another issue to consider here is that of the necessary trade-offs that have to be made between environmental and socio-economic development-oriented objectives. This is by no means an easy dilemma to resolve in a country with high levels of poverty and under-development.

The process whereby the cross-sector policy objectives were developed recognised the need to achieve horizontal alignment between different sectors by means of building a common understanding of terminology, key concepts and strategic intent across the water resource management, environmental and biodiversity management, land use, agriculture and integrated development planning sectors (Roux et al. 2006a: x).

Through participative negotiations, based on a recognised need for co-operation across sectors, a shared vision or goal statement was developed that seeks to balance priorities for socio-economic

development and conservation. It is expected simultaneously to facilitate the identification of those water resources that should receive a high level of protection in order to enable the effective conservation of inland water biodiversity. The goal that was adopted by the cross-sector representatives for inland water conservation is:

- To conserve a sample of the full variety or diversity of inland water ecosystems that occur in South Africa, including all species as well as the habitats, landscapes, rivers and other water bodies in which they occur, together with the ecosystem processes responsible for generating and maintaining this diversity, for both present and future generations.

While a common philosophy and goal is a necessary start to enable co-operation between different sectors, it is not likely to make a difference to inland water biodiversity conservation on the ground unless its idea is incorporated in a set of common operational objectives in which all actors agree on what should be done and who is to be responsible and accountable for certain tasks. Ideally, these operational objectives need to be clearly understood by all involved, developed collaboratively and implemented co-operatively (Roux et al. 2006a: x). Five cross-sector policy objectives were agreed to, namely:

1. Set and entrench quantitative conservation targets for freshwater biodiversity.
2. Plan for representation of inland water biodiversity.
3. Plan for persistence of inland water biodiversity.
4. Establish a portfolio of inland water conservation areas (which may include, but are not restricted to, formal protected areas); and
5. Enable effective implementation.

Objectives one to three deal with planning and design issues, while objectives four and five focus on implementation issues. These five objectives were further cascaded down into 20 implementation principles and approximately 50 cross-sector policy recommendations (Roux et al. 2006a).

### **2.3. EPI as defined for the purposes of this article**

For the purposes of this article, EPI is primarily defined as a normative policy objective which suggests that environmental objectives, and in this case those pertaining to inland water conservation, have for too long been neglected in the policy-making priorities of several sectors and should thus be accorded higher priority. On the other hand, an element of rational EPI is also present here, as this suggests that ‘early consideration of environmental objectives and addressing environmental problems close to the (sector) source are central tenets of the ecological modernisation paradigm’ (Persson 2004: 42). Thus while there is definitely a normative element present, namely the recognised need to do more to conserve inland water ecosystems, it is equally important to include the ‘rational’ buy-in of different sectors (especially those largely focused on social and economic development). This can be done by instilling in the decision-makers that to realise a healthy environment in these sectors it is necessary to achieve an improved standard of living for most South Africans. This especially applies to those who are living in rural areas and

who are directly dependent on, for instance, rivers and related ecosystem benefits and services to survive.

In this article EPI can be seen as a policy process with a focus on the communication, co-learning and co-operation that took place between the different sectors involved in formulating the national goal for conserving inland water biodiversity. Related to this are the five cross-sector policy objectives. What is equally significant here, however, is to make a link between the process followed and the outputs that are to be eventually achieved with the implementation of the cross-sector policy objectives. What form will these outputs take, who will take the responsibility for implementing them, will they fall in line with the envisaged cross-sector policy objectives and above all will they make it possible for the national goal to be realised?

Based on the choices made above, a predominantly normative view of EPI (while at the same time recognising that it contains a rational element) and a focus on EPI as a process (with the acknowledgement that its outputs and the impact thereof will eventually also have to be evaluated), the following definition can be formulated. EPI for the purposes of its particular case study can be defined as

A process, involving actors from government departments, conservation and science agencies that were based on mutual respect, co-operation, co-learning and creating a shared understanding of the problem at hand. A combined effort was made to develop a national inland water conservation goal and related cross-sector policy objectives by identifying and making use of the commonalities in the existing policies of the different sectors. Check font - FdB

Now that the conceptual issues of what is meant by policy, integration and EPI for the purposes of this paper have been clarified, the cross-sector policy objectives development process can be analysed in detail.

### **3. THE PROCESS THAT WAS FOLLOWED**

Using the article's definition of EPI and its associated conceptual issues, it now becomes important to analyse the process followed to develop the cross-sector policy objectives. Which elements of this were successful, and which were not, and, most importantly, what should be the way forward in ensuring that the objectives and the goal on which they are based are effectively implemented?

Roux et al. (2006b) argue for an unobstructed knowledge flow between scientists (producers of knowledge) and managers/decision-makers (users of knowledge). In the face of several challenges that exist in achieving optimal levels of alignment, compatibility and flow of knowledge between researchers, policy makers and resource managers, such as, misunderstandings, frustration, conflict,, it is important to recognise the existence of a knowledge interface between science and management, which not only provides a node for dialogue, but also makes possible the co-evolution of values, priorities, intent and action to increase the robustness of decision-making. Recognising a knowledge interface enables scientists and resource managers to become part of

a unified learning system and engage in a ‘joint fact-finding mission’ whereby new knowledge is created. As a function of this process the traditional roles of knowledge provider and knowledge user are combined into one which both sets of partners take on in order to negotiate outcomes that are feasible, desirable and acceptable, Of most consequence is that they should be directly focused on solving the practical day-to-day challenges faced by resource managers.

The process that was followed in drawing up the cross-sector policy objectives fits into the idea of knowledge sharing and co-learning discussed above. It involved a number of South African government departments and national conservation and science agencies participating in a series of small discussion groups. These were followed by two larger workshops to debate their respective mandates and strategies for managing and conserving freshwater ecosystems and biodiversity. The government departments involved were those responsible for water, environment, biodiversity, agriculture and development planning along with the participation of the National Parks Board. As mentioned above, the outcome took the form of a set of cross-sector policy objectives and implementation principles with policy recommendations (Roux et al. 2008).

## **4. LESSONS LEARNED FROM THE PROCESS**

### **4.1. Policy can and should be actively informed by best available science**

In order to enable the incorporation of science and the best available information into policy and management solutions with the problems associated with conserving inland water biodiversity, scientists participated in the above-mentioned series of discussions with the specific mandate of summarising scientific consensus and clarifying uncertainties and disagreements in a form that would be relevant to the respective policy contexts. Representatives from the different government departments were given the opportunity to internalise the presentations of what constituted ‘best available science’, and subsequently, together with the scientists present, negotiated the most feasible, desirable and acceptable policy options. Furthermore, it was acknowledged that the focus of the discussions was to extract science-based principles to aid with the harmonisation of future inland water conservation efforts (Roux et al. 2008).

While the level of co-operation between ‘knowledge producers’ and ‘knowledge users’ seems impressive given the successful negotiated outcome of the national conservation goal and cross-sector policy objectives, it is nonetheless disconcerting to note the ‘the uncertainty and lack of scientific validation’ around the twenty per cent benchmark of major inland water ecosystem types to be conserved in South Africa (Roux et al. 2008). This issue needs to be addressed and resolved when implementing the cross-sector policy objectives before or while setting and entrenching the quantitative conservation targets for freshwater biodiversity. Policy- and decision-makers in the different government sectors need to be able to trust and respect the views of scientists in order to be willing to incorporate ‘best available science’ into policies. The problem is that scientific consensus is not always easily achieved, especially considering that the scientific process is ongoing and that research is continuous.

## 4.2. Co-operation needs to be understood

Co-operation was for the purposes of the process defined as ‘parties actively working together for mutual benefit’. While co-operation certainly has several benefits, a number of limiting realities nonetheless exist. These include:

- more people increase the chance of opposition
- the benefits to all parties are not always explicit
- effective co-operation is not explicitly rewarded
- engaging in co-operation or co-operative activities may be perceived as an additional burden to both managers and scientists
- co-operation and its related requirements of forming a deeper understanding of another party’s issues require a deeper level of understanding; this process can be time-consuming, as individuals are required to spend more time together than originally planned
- bi-directional communication is challenging, especially the ‘listening’ part and many people are not experienced in this
- different organisations and individuals are prone to want to protect their ‘turf’
- continuity in relationships tends to break down as a result of high levels of staff turnover in both government departments and research agencies
- different organisations have different types of data bases hampers effective data sharing (Roux et al. 2008).

It is to be expected that such difficulties form part and parcel of the EPI process specifically given the various backgrounds and competing interests that representatives from different sectors or professions (i.e. scientists vs. resource managers) have. In addition to sector-based prejudices and barriers to co-operation, it also requires a particular personality to work together with people from backgrounds very different to your own. This requires recognising that a knowledge interface exists, listening with empathy, suspending your own knowledge system in order to take in other people’s points of view and being willing to negotiate and, if necessary, compromise in order to allow for the emergence of new values, priorities, intent and action in order to inform political decision-making (Benda et al. 2002: 1134).

Despite the difficulties mentioned above, with the different parties retaining their respective identities, active and respectful negotiations took place within professional boundaries and the cultural practices of the different participants. The minimum requirement for co-operation is a certain amount and quality of interaction over the course of time. This was attained through discussion groups and stakeholder meetings (Roux et al. 2008).

Of particular interest is that initiation and facilitation of the overall process was taken on by two external agencies, namely a national funding agency (WRC) and a national research agency (Council for Scientific and Industrial Research – CSIR). However, the collaborative workshops were chaired by a senior official from a lead participating department. This person showed a high level of intellectual interest in the issue, empathised with the operational realities of the different participants and espoused the desire for her department to work together with other actors for reasons of mutual and national benefit (Roux et al. 2008).



The dedication and political commitment of this chairperson, who has since left the government department she had been working for, as well as the considerable effort put in by the agencies which organised the workshops proved indispensable to the success of the process. It is disconcerting that inter-departmental negotiation could only take place through the considerable efforts of certain committed individuals and the inputs and facilitation of external, non-government agencies. The technical side of the cross-sector initiative has been rekindled under the title of 'Identifying and Enabling the Protection of National Freshwater Ecosystem Priority Areas for South Africa'. This process is once again being facilitated from outside of the mainstream government departments. The project team is planning on running a governance process in parallel to the technical process, although on this occasion it is likely to focus more on sub-national implementation agencies than national government.

This demonstrates that future co-operation between government departments is unlikely to happen unless it is facilitated from outside, which raises questions about the likelihood of success for the implementation of the cross-sector policy objectives. These are based on inter-sectoral communication and co-operation.

### **4.3. Cross-sector policies need to be integrated vertically and horizontally**

Policy integration of the cross-sector policy objectives for conserving South Africa's inland water biodiversity implied seeking harmonisation between biodiversity conservation objectives, water resource management objectives and policy objectives emanating from other co-responsible sectors. In order to achieve vertical and horizontal coherence of the different policies emanating from the different sectors concerned, the following steps were followed:

- international responsibilities based on signed treaties and conventions were identified and discussed
- concepts that are fundamental to future policy visions from within the respective sectors and that are relevant to the conservation of inland water biodiversity were discussed
- those concepts that are dominant or non-negotiable within respective sectors were flagged
- a set of science-based principles for inland water conservation planning and implementation was identified
- terminology differences were resolved through a consensus building approach and
- national goal and cross-sector policy objectives were formulated (Roux et al. 2008).

While it is commendable to facilitate and encourage the alignment of policy objectives from different sectors with different aims and responsibilities, perhaps the question should be raised of whether 'balancing' or 'harmonising' different objectives will ensure that inland water biodiversity conservation objectives do receive the attention they require. Lafferty and Holden (2003: 9) in their interpretation of EPI argue that the incorporation of environmental objectives into non-environmental policy sectors should be a guiding principle in the planning and execution of policy, and that environmental policies should take principled priority over other policies. With inland water biodiversity conservation thus far not having received enough attention and South Africa's inland water ecosystems being in a severely threatened state, it might perhaps be

necessary to make a case for prioritising their protection or at least giving protection equal status to other policy objectives, especially those in sectors that do not primarily deal with environmental protection. This suggestion in particular reflects the normative view of EPI that this article takes, namely that there is a moral need to protect inland water biodiversity in South Africa. This has not been done sufficiently., The cross-sector policy objectives document suggests this to some extent (Roux et al. 2006a). The other side to this argument, however, is that in a country marked by socio-economic inequalities and given that the South African government is determined to redress past inequities, such a suggestion is unlikely to be accepted at the national political level, unless it is very ingeniously and convincingly presented.

## **5. SUCCESSES AND LIMITATIONS OF THE PROCESS: DIALOGUE ACROSS SECTORS AND LEVELS OF GOVERNMENT NEEDS TO BE MAINTAINED AND EXPANDED**

The process described above, which succeeded in generating constructive debate among individuals from different sectors, demonstrates the value of a well-designed social process which enabled the establishment of important relationships, brought about a considerable degree of convergence in thinking and aided the drafting of a shared vision linked to practical actions. The process demonstrated that given the right combination of technical credibility, social skills, agency stability and patient persistence the internalisation of new scientific information by individuals within the policy domain can successfully take place (Roux et al. 2008).

However, the process also demonstrates some limitations, which are currently presenting an obstacle to the continued integration of the cross-sector policy objectives into policy at both the local and national level. When the WRC funded project came to an end with its set end date and fixed budget, so did the social process. The initial momentum of the remarkable knowledge-sharing and co-learning exercise whereby scientists and managers successfully established a common goal for the conservation of inland water biodiversity and associated cross-sector policy objectives has thus been lost and a considerable effort will have to be made to reignite a similar process in future. What becomes clear here is that the maintenance and continuation of the achievements gained through the cross-sector policy objectives process requires longer-lasting support and legitimacy than what the project budget and timeframe was able to provide. In addition an over-reliance on key individuals during the process has proven to be problematic as some important role-players, during the cross-sector policy negotiations, have been lost to new positions or new employers. In the case of this process, the premature ending of a project and its associated funding has effectively excluded the facilitating organisations from the process, whereas the departure of the influential chairperson capable of securing buy-in at the ministerial level has meant that the cross-sector policy objectives have not yet been converted into national-level policy in the form of a white paper. Future reference it is worth noting that such a process be institutionalised within at least the lead agency or department to ensure sufficient commitment and staff redundancy should a key individual be lost to the process. This necessitates finding an appropriate balance between personality-driven and enthusiastic building of personal legitimacy and an anchoring progress through bureaucratic mechanisms, such as, white or green papers, which will ensure the continuation of the process in the long run (Roux et al. 2008).

The effective implementation of any cross-sector policy requires the establishment and successful functioning of co-operative governance processes on the ground (MacKay & Ashton 2004: 1). In terms of a possible generic model for initiating co-operative governance processes in cross-sectoral policy implementation, as detailed by MacKay and Ashton (2004), the joint development of the cross-sector policy objectives has conformed to certain elements of the model thus far. So, for example, the cross-sector policy objectives have successfully been developed with the buy-in and participation of numerous stakeholders, who have identified and reached agreement on what the key priority issues are. Also, at a strategic level, and based on a shared understanding of how each of the priority issues affect society, the required interventions at the societal, governmental and local levels have been identified. These take the form of the implementation principles and policy recommendations. However, it now becomes important to take the cross-sector policy objectives one step further by communicating the vision that inspired their development to all responsible and related sectors to ensure buy-in at the operational level. Furthermore, at the local level a list of co-ordinated implementation activities needs to be drawn up to be implemented in order of priority, along with a set of clearly defined responsibilities (MacKay & Ashton 2004: 6).

This argument corresponds with the need to not only consider the successes and limitation of an EPI process, but also of its related outputs. The development of the cross-sector policy objectives can only be considered a complete success once their successful implementation on the ground has taken place. For various reasons this is a considerable challenge one of these is that the Catchment Management Agencies (CMAs), which will be responsible for certain water resources management functions in South Africa's nineteen water management areas, were identified as primary agencies responsible for achieving conservation targets at the catchment scale. This, however, necessitates a considerable degree of co-ordination of activities and resources within provincial and local spheres of government. This in turn means that these agencies need an appropriate level of internal knowledge and capacity in the fields of conservation science and aquatic ecology (Roux et al. 2008). Due to a lack of expertise of government officials and high levels of staff turnover, with many experienced, older staff members currently leaving or resigning, several government institutions are currently facing many challenges when it comes to carrying out their mandates.

Thus, while the process of developing cross-sector policy objectives for conserving South Africa's inland water biodiversity can overall be deemed a success in terms of the co-operation and co-learning that was achieved between different sectors, much still needs to be done before the link between process and outputs is firmly established. Plans now have to be developed to enable the continuation of this process. This should include buy-in at ministerial level, the development of a white paper to be presented for public comment and at Parliament and the re-establishment of a community of practice between scientists and members of the government agencies involved to further knowledge and planning concerning freshwater conservation in South Africa.

## NOTES

- 1 Nikki Funke is senior researcher, Water Resource Governance Systems Group, Council for Scientific and Industrial Research. Dirk Roux is Director, Water Research Node, Monash University South Africa.

- 2 'Biodiversity is the variability among living organisms. It includes diversity within and among species and diversity within and among ecosystems. Biodiversity is the source of many ecosystem goods, such as, food and genetic resources, and changes in biodiversity can influence the supply of ecosystem services' (Millennium Ecosystem Assessment 2003: 49) (the benefits people obtain from ecosystems, such as, the provision of food and water. .
- 3 An interesting definition here is that, 'law is a guide to public policy, a statement of what policy makers hope policy will be; but it is not necessarily public policy' (MacKenzie in Gerston 200x: 5). This implies that a considerable amount of political commitment, institutional capacity, practical implementation plans and successes are needed for this to be realised. This has been the case for the requirements stipulated in South Africa's Constitution, specifically the citizens' right to a safe and healthy environment for which it makes provision.

## REFERENCES

- Abell, R.A., J.D. Allan, and B. Lehner, 2007. Unlocking the potential of protected areas for freshwaters. *Biological Conservation* 134, 48–63.
- Benda, L.E., N.L. Poff, C Tague, M.A.Palmer, J. Pizzuto, S. Cooper, E.Stanley, and G.Moglen, G. 2002. How to avoid train wrecks when using science in environmental problem solving. *BioScience* 52: 1127-1136.
- de Coning, C. 2006. The nature and role of public policy. In F.Cloete, H. Wissink and C. de Coning eds. *Improving public policy: from theory to practice*. Pretoria: van Schaik Publishers.
- Gerston, L. N. 2004. *Public policy making: process and principles*. New York: M.E. Sharpe.
- Gilman, R.T., R.A. Abell and C.E. Williams 2004. How can conservation biology inform the practice of Integrated River Basin Management? *International Journal of River Basin Management* 2 (2): 1–14.
- Lafferty, W.M. and E. Hovden, 2003. Environmental policy integration: towards an analytical framework. *Environmental Politics*, 12(3), Autumn 2003: 1-22.
- MacKay, H.M. and P.J. Ashton 2004. Towards co-operative governance in the development and implementation of cross-sectoral policy: water policy as an example. *Water SA*, 30(3) No.1 January 2004: 1- 8.
- Millennium Ecosystem Assessment. 2003. *Ecosystems and human well-being: a framework for assessment*. Washington D.C.: Island Press.
- Nel, J.L., D.J. Roux, G. Maree, C.J. Kleynhans, J. Moolman, B. Reyers, M.Rouget, and R.M. Cowling, 2007. Rivers in peril inside and outside protected areas: a systematic approach to conservation assessment of river ecosystems. *Diversity and Distributions* 13: 341-352.
- OECD. 2003. *Policy coherence: vital for global development*. Policy brief. OECD.
- Persson, A. 2004. *Environmental Policy Integration: an introduction*. Policy Integration for Sustainability Background Paper. Stockholm: Stockholm Environment Institute.
- Roux, D.J., J.L. Nel, H.M. MacKay, and P.J.Ashton, 2006a. Discussion paper on cross-sector policy objectives for conserving South Africa's inland water biodiversity. Water Research Commission Report TT 276/06. Pretoria: Water Research Commission.
- Roux, D.J., K.H. Rogers, H.C. Biggs, P.J. Ashton, and A. Sergeant, 2006b. Bridging the science-management divide: moving from unidirectional knowledge transfer to knowledge interfacing and sharing. *Ecology and Society*, 11(1): 4.
- Roux, D.J., J.L. Nel, P.J. Ashton, A.R. Deacon, F.C. de Moor, D. Hardwick, L. Hill, C.J. Kleynhans, G.A. Maree, J. Moolman, and R.J. Scholes, 2008. Designing protected areas to conserve riverine biodiversity: lessons from a hypothetical redesign of the Kruger National Park. *Biological Conservation* 141: 100-117.

- Roux, D.J., P.J. Ashton, J.L. Nel, and H.M. MacKay 2008. Improving cross-sector policy integration and co-operation in support of freshwater conservation. *Conservation Biology* 22(6): 1382-1387.
- Skelton, P.H., J.A. Cambray, A. Lombard, and G.A. Benn, 1995. Patterns of distribution and conservation status of freshwater fishes in southern Africa. *South African Journal of Zoology*, 30 (3): 71–81.